WELCOME TO McMaster Pediatrics!

This handbook was designed for the large number of residents from a variety of disciplines that rotate through pediatrics during their first year of training. It may also be helpful for clinical clerks during their time on the pediatric wards, as well as for pediatric residents and elective students.

Hopefully this demystifies some of the ‘pediatric specific’ logistics, and gives a few practical suggestions for drug dosages and fluid requirements. This is intended only to act as a guideline for general pediatrics use, and some drugs, doses, indications and monitoring requirements may differ in individual situations. We would like to thank Mark Duffett (PICU pharmacist) for compiling and editing the pediatric formulary section and Dr. Moyez Ladhani for editing and supporting the production of this handbook. Drs Sarah Hall and Andrea Hunter for editing the original version.

We would very much appreciate any feedback, suggestions or contributions emailed to ladhanim@mcmaster.ca
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McMaster PEDIATRICS CONTACT INFORMATION

Wards
3B Back 76123, 76120
3C North 76345, 76344
3CSouth 73388, 76972
L2N 73753
NICU 76147
L & D 75050
4C Nursery 76354
PCCU 72610, 75692

Clinical
3F clinic 75012
2G clinic 75011
2Q clinic 75094, 75095
OR Reception 75645
PACU 75653
Short Stay 75564
Radiology 75279
MRI 75059
CT scan 73728-room
          75287-reception
Ultrasound 75316
EEG 4U 76363
ECHO 2F 75097
GI – pH probe

Labs
Stat Lab 76303
Bloodbank 76281
Coagulation 76288
Microbiology 76311
Pathology 76327

Administration
Paging 76443
Admitting 75100
Bed Booking 75106
Health Records 75112
Computer support 43000
Appointments 75051
Info Desk 75266
Security 76444
Room bookings 22382
Program Assistants
Postgraduates: Shirley Ferguson 75620
peded@mcmaster.ca
Adriana DiFilippo 73517
adifili@mcmaster.ca
Undergrad (clerks) Kim Babin 76712
pedclrk@mcmaster.ca
BCT residents: Heather Thomas 26660
thomh@mcmaster.ca
Family med residents: Jennifer Frid 76024
frid@mcmaster.ca
Wendy Milburn 905-575-1744 x203
milburn@mcmaster.ca

Chief Residents – Pediatrics
macpedschiefs@gmail.com
PAGING

To page someone from within the hospital:
1. dial 87
2. enter person’s pager number (4 digits)
3. enter call-back extension (5 digits)
4. enter priority code (∗∗ then 1 for CODE/STAT, 2 for ROUTINE, 3 for ANYTIME, 4 denotes PHYSICIAN paging)

If you don’t know their pager #, wish to leave a typed message or to wait on an outside line: call x76443

To inactivate/activate your own pager:
1. dial 87
2. enter your own pager #
3. dial 08

RTAS (Rapid Telephone Access System)
• For retrieval of dictated radiology reports not yet typed on Meditech

Internal access x75077
To access from outside (905) 521-5077

Security code 4123#
Patients ID # (9 digits)

1 – stop report
2 – resume play
3 – rewind
4 – slow down speed
5 – disconnect from system
6 – speed up
8 – next report
0 – go to start of report
# “A DAY IN THE LIFE OF PEDIATRICS”
## Division of General Pediatrics
### CTU 1, 2 and 3 Weekly Schedule

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<td>Resident Run Teaching MDCL 3020</td>
<td>Case Based Teaching</td>
<td>Teaching for Pediatric Residents MDCL3020, rest of team, see patients</td>
<td>PICU Rounds 4N55A</td>
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<td>9:00-10:30 (9:15-9:30)</td>
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<td>Patient Care/AHD</td>
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Please refer to attached document for details of each of the above.

*MDR = Multidisciplinary Rounds.

The detailed monthly schedule for this can be found at [www.macpeds.com](http://www.macpeds.com)

Updated: March 2010
**Division of General Pediatrics CTU 1, CTU 2, CTU 3 Weekly Schedule**

**Handover:**

Handover is to take place from 0715-0745 hrs. It is therefore important to complete a succinct handover within the allotted 30 minutes. The senior residents should touch base with the charge nurses from 3B/3C/L2N to review potential discharges.

**CTU Huddle/Discharge Rounds:**

CTU Huddle will take place each morning from 09:15 – 09:30 am Monday to Friday in the 3C conference Room. The three ward Attendings, the Senior Residents and Nurse Managers will attend and discuss potential discharges and bed management. Patients that can go home will be identified at this time and discharges for these patients should occur promptly. Discharge planning should always be occurring and patients that could potentially go home should be discussed by the team the night before. This would then be the time to ensure that if those patients are ready that the patients are discharged.

**See Patients:**

During this time the team will see their assigned patients. The chart and nursing notes should be reviewed to identify any issues that have arisen over night. The patient should be seen and examined. All lab work and radiological procedures that are pending should be reviewed. The house staff should then come up with a plan for the day and be ready to present that patient during ward rounds. It is not necessary that full notes be written at this time, as there will be time allotted for that later in the day.

**Ward Rounds:**

During ward rounds the attending paediatrician, with/without Senior Resident, and house staff will round on patients for their team. These are work rounds. All efforts should be made to go bedside to bedside to ensure that all patients are rounded on. Some spontaneous teaching during rounds and at the bedside can occur during this time, however there is allotted time for that later in the day.

Team 1 will start on 3B then proceed to 3C
Team 2 will start on 3C then proceed to 3B
Team 3 will start on L2N then 4C then proceed to the wards

**Case Based Teaching Team 1, Team 2, and Team 3:**

There is allotted time for case based teaching. The residents on the team are responsible for this case based teaching. A Junior Resident should be assigned by the Senior Pediatric Resident in advance to present at the case based teaching. The Junior Resident should present the case in an interactive manner to the rest of the teams. After which the Senior Resident should lead a discussion on that topic. For team three the Nurse Practitioner may be involved in presenting the case and the staff Pediatrician will have to play a supervisory role. The attending pediatricians are to attend these rounds to provide input. Please note that the case based teaching times from 8:00-9:00 hrs are protected times for learners on the teams. All work is to stop at 8:00 hrs and all 3 teams are to meet at that time. If at all possible all pages to learners at
this time should be avoided. Please note: patient care does take priority; patients waiting for ER consults etc should not be delayed to attend these rounds. Nurses and other health care professionals are welcome to attend these rounds.

Resident Run Teaching:

Time has been allotted for resident run teaching on Tuesday mornings 0800-0900 hrs. These should begin promptly at 0800 hrs. The schedule for these sessions will be put out separately. These sessions will review guidelines and protocols of the CPS and the AAP.

Protected Teaching for Pediatric Residents:

On Thursday morning there will be protected teaching for the pediatric resident ONLY. The rest of the team, at this time, will continue with discharge rounds and seeing patients. These sessions will include staff led case based teaching/bedside teaching, neonatal mock codes, and CanMEDS based sessions. The second Thursday of each month will be morbidity and mortality rounds and all learners should attend these.

Patient Care:

During this time residents will follow through with decisions made during ward rounds. They will finish charting on patients. This is also the time for them to get dictations done and to complete face sheets.

Teaching Sessions:

There are various teaching sessions throughout most days on the CTU. Please refer to the CTU teaching schedule for locations – this will be posted online as well as on the wards.

- Monday morning will be St Joes Grand Rounds; these will be teleconferenced to the McMaster Site in room 4E20. (8am-9am)
- Mondays from 15:00 to 16:00 – there will be either Bedside Teaching (see below) or Specialty teaching session. It is the goal during this time to get various specialties to come in and teach around patients that are on the ward.
- Bedside case teaching. All three teams are to meet at 15:00 hours on 3C. At this time the attendings will split the group up and do bedside teaching. The attendings will decide how to split the group up to get the maximum out of these sessions. Team 1 and 2 attendings are expected to be there and lead the session.
- Tuesdays from 08:00 to 09:00 – Resident run teaching as described above.
- Tuesdays from 15:00 to 16:00 - There will be sub-speciality teaching for the first 3 Tuesdays of the month. There will be Radiology Rounds on the 4th Tuesday of the month located in Radiology.
- Wednesdays from 08:00 to 09:00 – Case-based teaching run by the teams and the 4th Wednesday of the month will be Peds. Cardiology teaching – “Heart to Heart”.
- Wednesday is Academic Half Day
- Thursdays from 08:00 to 09:00 – Protected teaching for Peds Residents Only
- Thursdays from 15:00 to 16:00: The Thursday teaching will include lab teaching, asthma education, nutrition teaching and occasionally bedside teaching.
- Friday is for long cases. This would be the opportunity for the attending paediatricians to do at least one long case examination with the pediatric residents, if possible. All efforts
should be made to ensure that this does occur. However, depending on how busy the teams are there is not a mandatory expectation.

- Nurses and other health care professionals are welcome to attend these rounds.

**Evaluations:**

Time is left in the schedule for evaluations. This would be the time to give residents midway evaluations, as well as end of rotation evaluations.

**Handover 1630 hrs:**

Handover will occur to the on-call team.

**Orientation:**

At the beginning of each month all three attendings should meet with the three teams to review the objectives, expectation and schedule of the rotation. The senior resident may have valuable input during this time.

**Multi-Disciplinary Rounds:**

Team 3 will occur on Thursdays. The L2N patients will be discussed from 1300-1330, and the complex chronic patients will be discussed from 1330-1400. Team 1 and 2 will occur on Tuesdays. Team 1 will be from 1300-1330; Team 2 will be from 1330-1400.

Updated Jan 2010
RESOURCES

Handbooks/Pocketbooks:
• *Hospital for Sick Children Handbook* (11th ed, 2010).
• *Pediatrics on Call.*
• *Pediatric Drug Dosage Handbook* (on most wards)

Texts:
• *Pediatrics: A Primary Care Approach* (2nd ed) – STARS series: Carol D. Berkowitz.
• *Pediatric Clinical Clerkship Guide*

Clinical Skills:

Journals (all accessible via e-Resources at McMaster Libraries)
• *Pediatrics In Review*. Monthly publication by AAP (American Academy of Pediatrics), consisting of review articles and case presentations
• *Pediatrics*. Monthly publication by AAP.
• *Journal of Pediatric & Child Health*. Monthly publication of CPS (Canadian Pediatric Society).
WEBSITES

McMaster Pediatrics Residency Program
http://www.macpeds.com
Our residency program site that includes staff & resident presentations, subspecialty orientation materials, policy statements and our favourite links. Call schedules are also posted here in a password-protected area.

Canadian Pediatric Society - Position Statements
http://www.cps.ca/english/publications/StatementsIndex.htm
The main site also directs you to their journal (Pediatrics and Child Health) and a separate site for information for parents (Caring for Kids).

American Academy of Pediatrics (AAP)
http://www.aap.org/pubserv
The American equivalent of CPS, which has an expansive collection of practice guidelines and policy statements that are widely quoted.

Pediatrics in Review Journal
http://pedsinreview.aapjournals.org
An excellent resource for review articles on common problems and an approach to.... whatever! Online back to January 1997 in full text and pdf formats. Accessed through a McMaster e-Resources.

CDC Growth charts
http://www.cdc.gov/growthcharts/

SOGC Guidelines (Society of Obstetricians and Gynecologists of Canada)
http://www.sogc.org/SOGCnet/sogc_docs/common/guide/library_e.shtml
Evidence-based guidelines created by the SOGC, as indexed by topic area. Some of these are quite helpful in Level 2 Nursery and other newborn settings. Many others are quite helpful during your obs/gyn rotation!

Up-to-date
http://www.uptodate.com
An evidence-based summary of common topics in adult medicine and pediatrics. Available only on McMaster Hospital / Library computers, via HHSC Intranet.
MORE WEBSITES …

Dr. Ross Pennie's homepage - Peds Infectious Disease
http://www.fhs.mcmaster.ca/path/faculty/pennie.htm
Home of the Antibiotic Safety Zone and a new Immunization schedule.

Harriet Lane Links
http://derm.med.jhmi.edu/poi/
From the editors of the Harriet Lane Handbook is a full listing of all sorts of web links you could ever want within pediatrics.

Motherisk Program
http://www.motherisk.org/
A comprehensive program for evidence-based online information about the safety or risk of drugs, chemicals and disease during pregnancy and lactation based at Hospital for Sick Children.

National Advisory Council on Immunization (NACI)
http://www.phac-aspc.gc.ca/naci-ccni/tor_e.html
A program of the Canadian Public Health Association for educating parents and families, as well as health care professionals about the benefits and guidelines regarding childhood immunizations. Also links to Canadian Immunization Guide (2002).

Canadian Institute of Child Health (CICH)
http://www.cich.ca/index_eng.html
As their mission statement states “Dedicated to promoting and protecting the health, well-being and rights of all children and youth through monitoring, education and advocacy.”

PDA resources

• HSC Handbook and Harriet Lane both available on PDA

• Eponyms (http://www.healthypalmpilot.com) – free, short descriptions of genetic syndromes

• Epocrates (http://www.epocrates.com) – free, drug database
x5000 to enter, (905) 575-2550 externally

Enter Author ID (#)

Enter site (#)
- 11. General
- 12. Henderson
- **13. MUMC**
- 14. Chedoke

Enter Report Type (#)
- **21. Consultation**
- **22. Discharge**
- 3. Operative Report
- 4. Pre-op History & Physical
- **25. Clinic Note**

Enter Chart Number (#) – the ID # after the ‘M’

Enter Patient Type (#)
- 1. Inpatient
- 2. Outpatient
- 3. ER
- 4. Child & Family

Press 2 to dictate, *5 to disconnect

1. Hold
2. Pause/Continue
3. Skipback/Play
4. Fast Forward (44 to move to end)
5. Disconnect
6. Prioritize
7. Rewind (77 rewind to beginning)
8. End Report

For each report:
- your name, patient name (spelling if difficult)
- chart number, work type, copies to (FD, pediatrician, consultants, MRP, etc)
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<td>Ramachanran Nair</td>
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<td>Zaki, E</td>
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ST. JOSEPH’S HOSPITAL PEDIATRICS

Hospital Contact Numbers

<table>
<thead>
<tr>
<th>Service</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto attendant</td>
<td>(905) 522-1155</td>
</tr>
<tr>
<td>Switchboard</td>
<td>(905) 522-4941</td>
</tr>
<tr>
<td>Labour and Delivery</td>
<td>33251, 34157</td>
</tr>
<tr>
<td>NICU</td>
<td>36050</td>
</tr>
<tr>
<td>3 OBS (Well Babies Nursery)</td>
<td>33314</td>
</tr>
<tr>
<td>Paging</td>
<td>33311</td>
</tr>
<tr>
<td>Dr Sandi Seigel</td>
<td>36039</td>
</tr>
<tr>
<td>Deputy Chief St Joes Clinical</td>
<td><a href="mailto:seigels@mcmaster.ca">seigels@mcmaster.ca</a></td>
</tr>
<tr>
<td>Dr. Moyez Ladhani</td>
<td>36039</td>
</tr>
<tr>
<td>Deputy Chief Education</td>
<td><a href="mailto:ladhanim@mcmaster.ca">ladhanim@mcmaster.ca</a></td>
</tr>
<tr>
<td>Rosie Evered</td>
<td>36039</td>
</tr>
<tr>
<td>Program Secretary</td>
<td><a href="mailto:revered@stjoesham.on.ca">revered@stjoesham.on.ca</a></td>
</tr>
</tbody>
</table>

Paging (33311) and Pagers:
- All paging done via switchboard attendant at extension 33311
- Resident on-call usually carries pager # 412
- Clerk on-call usually carries pager # 410
- Page staff pediatrician on-call through paging (33311)
- McMaster assigns most pagers, check with program area
- If pager needed, sign out daily pagers at Switchboard

Library Services:
- 2nd Floor of Juravinski Tower
- Hours: MON, WED, FRI 8:00 AM – 6:00 PM
  TUES, THURS 8:00 AM – 8:00 PM
- X33440 or library@stjosham.on.ca
# ST JOSEPH’S HOSPITAL ORIENTATION

## DAILY SCHEDULE

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>7:30 AM</td>
<td>Handover (3OBS Conference Room across from NICU)</td>
</tr>
<tr>
<td></td>
<td>Weekend/ Holiday Handover occurs at <strong>8:30am</strong></td>
</tr>
<tr>
<td>8:00 AM</td>
<td>Teaching (Check monthly schedule for topics/location)</td>
</tr>
<tr>
<td><strong>MON</strong></td>
<td>8:00 – 9:00 AM → Pediatric Grand Rounds</td>
</tr>
<tr>
<td></td>
<td>Campbell Auditorium</td>
</tr>
<tr>
<td></td>
<td>Rm 2022, New Tower</td>
</tr>
<tr>
<td><strong>FRI</strong></td>
<td>8:00 – 9:00 AM → Perinatal Rounds</td>
</tr>
<tr>
<td></td>
<td>3rd Floor OBS Conf Rm</td>
</tr>
<tr>
<td>9:00 AM</td>
<td>Pre-round → examine patients, check labs</td>
</tr>
<tr>
<td>10:00 AM</td>
<td>Rounds with Attending Staff</td>
</tr>
<tr>
<td>12:00 PM</td>
<td>Lunch/ Teaching Session</td>
</tr>
<tr>
<td>1:00 PM</td>
<td>Finish Notes, orders, investigations, L&amp;D, admissions, new consultations in ER, discharges</td>
</tr>
<tr>
<td>4:30 PM</td>
<td>Handover (3OBS Conference Room across from NICU)</td>
</tr>
</tbody>
</table>

### Presentations done by Residents:
- Grand Rounds - last Monday of month
- Perinatal Rounds - 3rd Friday of month

### **All Clerks and Residents should attend**:
- *BANA* (Breastfeeding and Nutrition Assessment) &
- *Asthma Education Clinic* for a half-day each, during their rotation.

### Pediatrics Responsibilities:
- Attend any ‘at-risk’ deliveries in L & D
- 3rd floor Dowling Wing (OBS) newborn consults, from family physicians and midwives
- NICU inpatient coverage - 15-20 beds
- Pediatric Short Stay Unit in ER
  - Referrals directly from family MDs, ER physicians etc
  - Admissions up to 24 hours (then require transfer to MUMC)
Accommodation Services

On-Call Rooms:
• **Key:** sign out from Front Desk/ Switchboard, must be returned by 11:00 AM the next day
• **Location:** 2nd floor, Resident call room # 213
  → follow Gold Signs to Father O’Sullivan Research Centre
• **Additional Key:** unlock Washrooms + Showers or Code 2 4 3
• **Residents’ Lounge** (Microwave & TV): Code 2 4 3
  → across from vending machines on 2nd floor before call rooms
• **Problems:** communicate to Switchboard or Mike Heenan x2218

Cafeteria Hours:

<table>
<thead>
<tr>
<th>Location</th>
<th>MON – FRI:</th>
<th>SAT – SUN:</th>
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<tr>
<td>Charlton Cafeteria</td>
<td>7:30 AM – 6:00 PM</td>
<td>9:30 AM – 2:30 PM</td>
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<tr>
<td>2nd Floor, Mary Grace Wing</td>
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<tr>
<td>Garden Café @ CMHS</td>
<td>9:30 AM – 10:30 PM &amp; 11:30 AM – 1:30 PM</td>
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<tr>
<td>Charlton Second Cup</td>
<td>Daily:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7:00 AM – 10:00 PM</td>
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Information Services

Clinical Brower Passwords & Training:
• **Passwords obtained from:** Computer Room
  2nd Floor of Mary Grace Wing
  x32218 for Passwords
• Must accept password and confidentiality agreements by signature
• For additional information on Clinical Browser or training call:
  Shauna Stricker x35286

PACS Passwords & Training:
• PACS passwords same as Clinical Browser, except all UPPERCASE
• You may change your password once you have logged on
• PACS training is only offered at the Monthly Medical Learner Orientation Sessions. For session dates and times contact:
  Diane Larwood 34077
Telephone Dictation Instructions

If on-site dial: Extension 2078
If outside the facility dial: 905 522-1155 Extension 2078

Once connected, initial greeting “Welcome to .....” Dictation System” will play.

1. Enter your User ID followed by the {#} key.

2. Enter the Work type followed by the {#} key.

3. Enter the Patients Medical Record Number followed by the {#} key.

4. Press {2} to begin dictating.

5. Press {9} to complete the dictation and hang-up the telephone, OR Press {5} to begin a new dictation (begin at Step 2.)

See Telephone Keypad Instructions On Back

Telephone Keypad Controls

[1] = Play
[2] = Record / Pause (toggle key)
[3] = Rewind w/Playback (may press several times)
[4] = Pause
[5] = Start second dictation
[6] = Go to end of dictation
[7] = Continuous Forward
[8] = Go to beginning of dictation
[9] = Disconnect from system

Dictation Report Types

CHARLTON SITE
1. Consultation Note
2. Discharge Summary
3. Operative Report
4. Pre Anesthetic Clinic
5. Clinic (Fracture and Out-Patient)
6. Endoscopy
7. EDS (EVPs and EMGs)
13. Procedure Note
21. Maternal Quality of Care Committee

CMHS SITE
8. LOA
9. Psychological Testing
10. Social Work
11. Consultation Note
12. Discharge Summary

CAHS SITE
14. Procedure Note
15. Clinic Note
LISTENING TO DICTATED REPORTS AT ST JOSEPH’S HEALTHCARE

- Use telephone to listen to Diagnostic Imaging Reports that have been dictated but not yet transcribed
- Requires Check-In # of your Patient’s Exam. Found in Check-In # field (usually beside Patient’s Name) on any PACS Workstation
- If you are unable to find Check-In # field on the Workstation, then call Diagnostic Imaging staff for assistance: x33606 or x36009

Instructions

1. DIAL 32078 to access the central dictation system.

2. PRESS the # sign.
   It is Important that you PRESS THE # SIGN to LISTEN, because 32078 is also used to DICTATE reports.

3. PRESS 1. Enter Physician Author Dictation ID Number (0995)

4. PRESS 1.

5. Enter Patient’s 7-digit Check-In #

6. LISTEN to the report

- Press 5 to listen to a previous exam report on your patient, if the report you are hearing is not the one you requested
- If you have entered the wrong check-in number or if would like to hear another report, follow the verbal prompts, Press 1 then repeat Steps 5 & 6
PEDIATRIC HISTORY & PHYSICAL EXAMINATION

HISTORY

Identifying Data:
- Name, sex, age (years + months), race, who accompanies child, significant PMHx

Chief Complaint: in patient’s or parent’s words

History of Presenting Illness (HPI):
- Open-ended question, and allow parents or child to express their concerns
- Similar HPI details to an adult history
- Establish time line: “when was your child last well?”, “what happened next?” etc
- Select key symptoms and expand:
  - colour, character, quantity of vomit etc,
  - OPQRST of pain, aggravating/relieving factors etc
- Always ask about recent exposures to ill contacts – family, school

Past Medical History (PMHx):
- Significant ongoing medical problems
- Prenatal history:
  - Mother’s age, gravida, live births, abortions etc
  - Planned vs unplanned pregnancy, onset of prenatal care
  - Complications, smoking, drinking, meds, drug use in pregnancy
  - Gestational age at birth
- Birth history:
  - Spontaneous vs induced labour, duration, complications
  - Presentation: breech, vertex, transverse
  - Interventions required: forceps, vacuum, c-section
  - Resuscitation required, Apgars, birth weight (conversion chart)
  - NICU, Level 2 nursery admission, duration
- Newborn history:
  - Common problems: jaundice, poor feeding, difficulty breathing
- Hospitalizations and significant accidents
- Surgical history

Medications – including dose changes, compliance
Allergies – list specific reaction
* Immunizations – ask specifically about Prevnar, Menjugate, Varivax
PEDIATRIC HISTORY AND PHYSICAL EXAMINATION (Continued)

Feeding History (if relevant):
- Breast feeding: exclusively?, duration, frequency
- Formula: brand, how is it prepared/diluted, # of feedings/day, quantity
- Solids: when started, tolerated, any reactions
- Vitamins (especially iron and Vit D): which ones, how often, dose
- Present diet: cereals, fruit, veggies, eggs, meat, amount of cow’s milk
- Any difficulties with feeding?

Developmental Milestones (if relevant):
- Have you ever had any concerns about your child’s development?
- How does child compare with siblings?
- Ask about current milestones in each category as appropriate for their age:
  - Gross motor
  - Fine motor, vision
  - Speech, hearing
  - Social skills
- Use major milestones (walking, first word, toilet training, etc) to assess previous development (*Reference on page 38*)
- Use Denver II charts etc to assess current stage of development

Social History
- Who lives at home? Who are primary caregivers? Parents work outside the home?
- Does the child attend daycare? How many other children? In a home vs. institution?
- Stability of support network: relationship stability, frequent moves, major events (death in family etc), financial problems, substance abuse in the home
- School adjustment, behaviour problems, habits (nail-biting, thumbsucking etc), sleep changes
- How has this disease affected your child/ your family?
- What does your family do for fun? What does your child do for fun?
- For an asthma history: smoke, pets, carpets, allergens in the home, family history of asthma / atopy.
PEDIATRIC HISTORY AND PHYSICAL EXAMINATION (Continued)

Family History:
- Are parents both alive and well? How many siblings? Are they healthy?
- Are there any childhood diseases in the family?
- Consanguinity – are mother and father related in any way?
- Relevant family history (3 generations) – autoimmune hx in Type I DM, atopic hx in asthma etc
- Draw pedigree if possible for genetic assessment

Review of Systems:
General: feeding, sleeping, growing, energy level
Signs of illness in kids: activity, appetite, attitude (3 A’s)

HEENT: infections (how often, fever, duration): otitis, nasal discharge, colds, sore throats, coughs, nosebleeds, swollen glands, coughing or choking with feeding

Cardio:
Infants: fatigue/sweating during feedings, cyanosis, apneas/bradycardic episodes
Older kids: syncope, murmurs, palpitations, exercise intolerance

Resp: cough, wheezing, croup, snoring, respiratory infections

GI: appetite, weight gain (growth chart), nausea/vomiting, bowel habits, abdominal pains

GU: urinary: pain/frequency/urgency, sexually active, menarche/menses, discharge/pruritis/STDs

MSK: weakness, sensory changes, myalgias, arthralgias, ‘growing pains’

Neuro: headaches, seizures (febrile vs afebrile, onset, frequency, type), tics, staring spells, head trauma

Skin: rashes, petechiae, jaundice, infection, birthmarks
PHYSICAL EXAMINATION

General Inspection
- Sick vs not sick?
- Toxic appearance? listlessness, agitation, failure to recognize parents, inadequate circulation (cool extremities; weak, rapid pulse; poor capillary refill; cyanotic, gray, or mottled colour), respiratory distress, purpura
- Level of consciousness
- Nutritional status – well nourished?
- Developmental status (“pulling up to stand in crib”, “running around room”)
- Dysmorphic features – look specifically at face, ears, hands, feet, genetalia

Vital Signs:
- Include Temperature, Heart Rate, Respiratory Rate, Blood Pressure and O₂ saturation

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<th>Age</th>
<th>HR</th>
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<td>120-160</td>
<td>60-70</td>
<td>30-60</td>
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<tr>
<td>Neonate (&lt;1 mos)</td>
<td>120-160</td>
<td>75-90</td>
<td>30-60</td>
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<tr>
<td>Infant (&lt;1 year)</td>
<td>110-140</td>
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<td>20-40</td>
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<tr>
<td>Preschool (3-5yrs)</td>
<td>90-120</td>
<td>75-125</td>
<td>20-25</td>
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<td>Child (6-12 yrs)</td>
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<td>83-120</td>
<td>16-24</td>
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<td>Adolescent (&gt;12 y)</td>
<td>70-100</td>
<td>90-130</td>
<td>12-18</td>
</tr>
<tr>
<td>Adult (&gt;18 yrs)</td>
<td>60-100</td>
<td>90-130</td>
<td>12-18</td>
</tr>
</tbody>
</table>

Anthropometrics (plot on growth curves at every visit!):
- Height (supine length to 2 years, then standing height)
- Weight
- Head circumference (generally birth to 2 years, >2 yrs if specific concerns)
- Plot BMI (kg/m²) on updated CDC growth curves for appropriate BMI for age
- CDC Growth Curves available at: http://www.cdc.gov/nchs/about/major/nhanes/growthcharts/clinical_charts.htm
PEDiATRIC hISTORY AND PHYSICAL EXAMINATION (continued)

Hydration Status
- Comment on mucous membranes, tears, skin turgor, sunken eyes, in addition to appropriateness of vital signs, etc
- For classification of mild, moderate, severe dehydration – see “Fluids & Electrolytes”

HeENT:
- Head: dysmorphic features, shape of skull, head circumference, fontanels in infants
- Eyes: strabismus, pupillary response, fundoscopy, red reflex in infants, conjunctivitis
- Ears & pharynx exam in any child with a fever!
- Nose: turbinates, deviation of septum, presence of polyps?
- Mouth: lips (lesions, colour), mucous membranes including gingiva, tongue, hard/soft palate,
- Dentition: presence of teeth, tooth decay
- Neck: lymphadenopathy, palpation of thyroid, webbing (Noonan, Turner syndrome), torticollis

Cardiovascular:
- HR, BP, apical beat, heaves/thrills
- S1/S2, extra heart sounds (S3, S4)
- Murmurs:
  - Timing (systole, diastole, continuous)
  - Location of maximal intensity, radiation
  - Pitch and quality (machinery, vibratory, etc),
  - Loudness (I – VI / VI)
- Perfusion:
  - Pulses – strength/quality, femoral pulses in all infants
  - Capillary refill time
  - Skin colour: pink, central/peripheral cyanosis, mottling, pallor

Respiratory:
- Audible stridor, sturtor, wheeze, snoring
- Position of child, ability to handle secretions
- RR, O2 saturation (current FiO2), level of distress
- Able to speak in full sentences (if age appropriate)
- Depth and rhythm of respiration
- Signs of distress: Nasal flaring, tracheal tug, indrawing
- Chest wall deformities: kyphosis, scoliosis, pectus excavatum/carinatum
- Finger clubbing
PEDIATRIC HISTORY AND PHYSICAL EXAMINATION (Continued)

Abdomen:
- For peritoneal signs: ask child to jump up and down or wiggle hips, to distend and retract abdomen “blow up your belly and then suck it in”
- Inspection: scaphoid/distended, umbilical hernias, diastasis recti
- Auscultation: presence of bowel sounds
- Percussion: ascites, liver span, Traube’s space for splenomegaly
- Palpation: hepatosplenicmegaly?, tenderness, guarding (voluntary, involuntary), masses (particularly stool presence in LLQ)
- Stigmata of liver disease: jaundice, pruritis, bruising/bleeding, palmar erythema, caput medusa, telangiectasia, ascites, hepatosplenomegaly

Genito-urinary:
- Anal position, external inspection (digital rectal examination in kids ONLY with clinical indication), Tanner staging
- Male infants: both testes descended, hypospadias, inguinal hernias
- Females: labia majora/minora, vaginal discharge, erythema/excoriation of vulvo-vaginitis (NO speculum exam if pre-pubertal)

MSK:
- Gait assessment, flat feet vs toe walking vs normal foot arches
- Standing: genu valgum “knock knee” vs genu varum “bow legged”
- Joints: erythema, swelling, position, active/passive range of motion, strength, muscle symmetry
- Back: kyphosis, scoliosis

Neurological:
- Overall developmental assessment
  - Try playing ball with younger children, or even peek-a-boo!
- Level of consciousness (Glasgow Coma Scale if appropriate)
- Newborns: primitive reflexes, moving all limbs, presence of fisting?
- Cranial nerves: by observation in infants, formal testing in older children
- Motor: strength, tone, deep tendon reflexes, coordination
- Sensory: touch, temperature, position/vibration sense
- Cerebellar: gait (heel to toe, on heels, on toes, finger-to-nose, rapid alternating movements in older children, Romberg (eyes open then closed)

Derm:
- Jaundice, pallor, mottling, petechiae/purpura
- Rashes, birthmarks, hemangiomas, stigmata of neurocutaneous disorders
ADOLESCENT INTERVIEWING (HEADDSS)

- Interview teens alone with parents invited to join at the end
- Allow adequate, uninterrupted time to inquire about all aspects of their life, and high-risk behaviours in private setting
- Assure **confidentiality** at beginning of interview, and prior to discussing drug use and sexuality

**Home**
- Tell me what home is like…
- Who lives at home? How does everyone get along? What do you argue about?
- Family members – ages, occupations/education, health status, substance abuse

**Education / Employment**
- Name of school, grade level, attendance pattern
- Most favourite/least favourite courses, marks in each course, change in marks recently?
- Part-time / full-time job – for $ or ‘experience’

**Activities**
- What do you do for fun? On weekends?
- Do you feel you have enough friends? Who are your best friends? What do you do together?
- Sports / Exercise, extra-curricular activities

**Drugs**
- Have you ever tried cigarettes? Alcohol? Marijuana?
- Ever drunk?
- For younger teens: ask about friends’ use and peer pressure
- Cover all drug classes: hallucinogens, amphetamines, rave drugs, IV drugs, crack cocaine, OTC meds, anabolic steroids
- What age did you start? Frequency of use? How much?
- What do you like/dislike about X? Why do you use X?
- Do you use alone? Any police involvement? Dealing?
ADOLESCENT INTERVIEWING (Continued)

Dieting
- Do you have concerns about your weight/shape?
- Have you tried to change your weight/shape in any way? (dieting/exercise)
- Presence of bingeing/purging behaviours, use of diuretics/laxatives
- Tell me what you eat/drink in an average day…
- ~20% of teens are on a diet at any one time, up to 66% have tried to lose weight in the past
- Use BMI curves to estimate ‘healthy weight’ for teen based on height

Sexuality  Over 2/3 of teens have had one sexual partner by age 18
- Are you interested in the same sex, opposite sex or both? (DO NOT assume heterosexuality!)
- Are you dating someone now? Are you having sex? What do you use for contraception/STI prevention (condoms, OCP, Depot, etc)
- Number of sexual partners / age of first sexual activity/STI history / last pelvic exam in females / ever tested for STIs, HIV?

Suicide / Depression
- Screen for depression (SIGECAPS)
- Have you lost interest in things you previously enjoyed?
- How would you describe your mood? On a scale of 1-10?
- Any change in sleep pattern? Ability to concentrate?
- Have you had any thoughts about hurting yourself?

Safety
- Do you regularly use: seatbelts? Bike helmets? Appropriate gear when snowboarding/skateboarding?
- Does anyone at home own a gun?
- Has anyone ever hurt you or touched you in a way that was harmful or inappropriate?
<table>
<thead>
<tr>
<th>WEIGHT CONVERSION CHART</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OUNCES</strong></td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
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<tr>
<td>7</td>
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<td>8</td>
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<td>9</td>
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<td>10</td>
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<tr>
<td>11</td>
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<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>15</td>
</tr>
</tbody>
</table>
ADMISSION ORDERS (ADDAVID)

Admit: Admit to (Ward 3B/3C/NICU/L2N) under (staff name, Team #)

Diagnosis: Confirmed or Suspected (eg. UTI with 2° dehydration)

Diet: DAT (diet as tolerated) NPO (nothing per os/by mouth; if going for surgery or procedures) Sips Only, CF (Clear Fluids), FF (Full Fluids), Thickened Fluids (dysphagia), Advancing Diet (NPO to sips to clear fluids to full fluids to DAT), Diabetic Diet (indicate Calories eg. 1800 Kcal, 2200 Kcal), Cardiac Diet, TPN etc. Include amount, frequency, rate if applicable.

Activity: AAT (Activity as Tolerated), NWB (Non-Weight bearing), FWB (Full Weight bearing), BR (Bed Rest), BR with BRP (Bed Rest with Bathroom Privileges), Ambulation (Up in Chair Tid, Ambulate bid)

Vital Signs: VSR (Vital Signs Routine (HR, RR, BP, O2 sat, Temp. q 8-12 hours, q shift), VS q4h (if particularly sick patient requiring more frequent vitals), Special parameters (eg. Postural vitals, Neuro vitals)

Monitor: Accurate Ins & Outs (Surgery, volume status pts.) Daily weights (eg. Renal failure, edematous, infants)

Investigations:

Hematology: CBC + diff, PTT/INR
Biochemistry: Electrolytes (Na⁺, K⁺, Cl⁻, HCO₃⁻), Urea, Creatinine, Ca²⁺, Mg²⁺, PO₄⁻, glucose, CSF cell count, CSF protein and glucose
Microbiology: Urine R&M/C&S, Blood Cultures, CSF from LP for gram stain, C&S. For this section just remember all the things you can culture: CSF, Sputum, Urine, Feces, Pus from wounds, Blood
Imaging: CXR, CT, MRI, EKG, PFT, Spirometry
Consults: Social Work, Neurology, Infectious Diseases

Drugs
All medications patient is already on (Past), medications the patient needs right now (Present), anticipate what the patient might need: prophylaxis, sleep, nausea and pain (Future)
10 Patient P’s: Problems (specific medical issues), Pain (analgesia), Pus (antimicrobials), Puke (anti-emetics, prokinetics, antacids), Pee (IV fluids, diuretics, electrolytes), Poop (bowel routine), Pillow (sedation), PE (anticoagulation), Psych (DTs), Previous Meds

Ensure you date and time your orders, put the child’s weight and list any allergies on the order sheet. Make sure you sign the order sheet and write your name legibly and pager number.
PROGRESS NOTE: PEDIATRICS

General Pediatrics Ward (3B/3C) – Clinical Clerk Progress Note

Date * Always note the Date, Time, Your Name and Pager Number *

Time

ID: age, sex with a history of (non-active/chronic issues/previous well) admitted with (list active/acute issues for why patient is admitted)

eg. 18 mo ♀ previously healthy, admitted with a UTI and 2° dehydration

Subjective:

S: How patient’s night was (O/N) and how they feel that day and any new concerns they have. What has changed since the previous note. Does the patient have any new symptoms? How is the patient coping with the active symptoms, progression, better/worse. If patient is non-verbal, ask the parents or patient’s nurse. Remember to ask about: behaviour, activity, sleep, appetite, in and outs.

Objective:

O: General: Patient disposition (irritable, sleeping, alert), general appearance, behaviour, cognition, cooperation, disposition

Vitals: HR, BP, RR, SaO₂ (on Room Air/NP with rate or %), Temp (PO/PR/AX), weight (daily, with changes noted), Inputs (Diet, IV fluids and rate), Output (Urine Output, BM/Diarrhea, Vomiting, Drains)

Vitals: Temp (PO or PR or Axilla?), HR, RR, BP, SaO₂ (on room air? 24%? 2L?)

Focused P/E of system involved plus CVS, RESP, ABDO, EXT/MSK common for hospitalized patients to develop problems in these systems

Investigations (Ix): New lab results, imaging or diagnostic tests/interventions

MEDS: reviewed daily for changes regarding those that are new/hold/discontinued/restarted

Assessment & Plan\Impression (A/P or Imp):

Summarize what the new findings mean, what progress is being made Improved? Stable? Waiting investigations/consult? Differential Diagnosis if anything has been ruled in/out

Plan (A/P or I/P):

Issue (1) → eg. UTI → Day 2 of Empiric Abx, likely 14 day course required. Awaiting culture and sensitivity

Issue (2) → eg. Dehydration → Intake still minimal, Urea mildly elevated, clinically dehydrated therefore continue IVF at 50 ml/hr Encourage oral fluids

Name, Designation (CC\PGY), Pager Number

Discussed with Dr. _________________
Documentation

- Colleges and legislation define good documentation
- Essential part of being a competent physician
- Provides communication amongst team members and other physicians

- Information documented in chart belongs to the patient — you are the caretaker
- ALL notes in medical records should be written with expectation that they will be viewed by the patient and/or their legal representative

PROFESSIONALISM

- Colleges require a written, legible, medical record accompany patient encounters, as a standard of practice
- Hospitals require documentation be done in a timely manner
- Documentation should provide a clear indication of physician's thought process

Documentation in clinical notes should:
- Be factual, objective, and appropriate to the purpose
- Be dated and timed (preferably with 2400 clock)
- Provide chronological information
- Be written in a timely manner
- Be legible, including signature and training level
- Use only well-recognized abbreviations
Documentation should allow someone to determine:
- Who attended the appointment (i.e. mother, father)
- What happened
- To whom
- By whom
- When
- Why
- Result
- Impression
- Plan
- Late entries must be recorded as such
- Phone contact should also be timed

Choose words carefully – use:
‘Reported no…..’ VS ‘denied’
‘Declined’ VS ‘refused’

Avoid subjective and/or disparaging comments relating to the care provided by other HCP.

Doubts about a colleague's treatment decisions should not be recorded in medical records. Better to talk to your colleague instead.

Write only what YOU did or did not do. You cannot testify to the truth of the event if no personal knowledge.

- If negative event occurs, document what steps you took (who notified, course of action). Again write no comments as to what others did, will do, or said, etc. Notes may be written elsewhere (not in chart) in the event of potential litigation, but these notes are not protected,
NEVER change, tamper or add to a medical record. Any subsequent additions or changes should be dated and signed at the time you make them, to avoid undermining the credibility of any changes.

- Do NOT later change an existing entry.
- Do NOT black-out or white-out words or areas.
- Do NOT insert entries between lines or along the margins of the chart as these may appear to have been added later, casting doubt on their reliability.
- Do NOT add an addendum to the chart after learning of a legal action, threat of a legal action or other patient complaint.

Poor charting may be perceived as reflecting less attention to detail, risking the conclusion that care provided was poor.
Today’s date
My name, designation (i.e. resident, clinical clerk)
Attending MD
Patient name, ID#
Copies of this report to: FD, pediatrician, MRP, consultants, medical records

Date of Admission:
Date of Discharge:
“Start of dictation”

DISCHARGE DIAGNOSIS:
1., 2. etc

OTHER (non-active) DIAGNOSIS:
1., 2. etc

FOLLOW-UP: (appointments, pending investigations, home care)

DISCHARGE MEDICATIONS: (dose, frequency, route and duration)
1. , 2. etc

HISTORY OF PRESENTING ILLNESS:
- A brief description of the events leading up to admission

PAST MEDICAL HISTORY:
- Including birth history, development, past investigations/treatment, immunizations etc as appropriate

PHYSICAL EXAMINATION:
- An overview of pertinent findings on admission, and to outline baseline status

COURSE IN HOSPITAL:
- Describe briefly the events and progression of illness while in hospital
- If the child has multiple medical issues, this section can be done by system (cardiovascular, respiratory, fluids and nutrition, ID, hematological, CNS, etc)
- List complex investigations (with results) under a separate heading.

State your name, designation; Attending MD name
Press 8 to end dictation, and write down job # on face-sheet of chart
QUALITY DOCUMENTATION INITIATIVE

Discharge Summary Template

**Diagnosis on Admission:** Includes most responsible diagnosis for hospital admission

**Diagnosis at Discharge:** Includes most responsible diagnosis for hospital admission as well as co-morbid conditions identified either at time of admission or during the hospital admission as well as complications developed during course in hospital

**Procedures:** Includes a comprehensive list of procedures performed during hospital admission for definitive treatment, diagnostic or exploratory purposes

**Course in Hospital:** Includes a detailed comprehensive list of critical events while in hospital, complications, response to treatment

**Discharge Medications:** Includes a comprehensive list of medications, active at discharge, dosage and mode of administration

**Discharge Plans/ Follow-up:** Includes a comprehensive list of appointments, treatments, referrals, recommendations and follow-up including responsible physician(s), health care team(s), or agency involved, including arrangements for aftercare
FLUID MANAGEMENT IN CHILDREN

3 Components to Fluid Management:
1. Maintenance
2. Deficit Replacement
3. Ongoing Losses Replacement

1. Maintenance
- Fluid and electrolyte requirements are directly related to metabolic rate
- **Holliday-Segar Rule** - calculation of maintenance fluid requirements using body weight for resting hospitalized patients (based on 100 cc for each 100 kcal expended):

<table>
<thead>
<tr>
<th>Body Weight</th>
<th>Volume in 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 10 kg</td>
<td>100 cc/kg/d (1,000 cc for 10kg child/day)</td>
</tr>
<tr>
<td>11- 20 kg</td>
<td>1,000 + 50 cc/kg above 10 kg</td>
</tr>
<tr>
<td>Above 20 kg</td>
<td>1,500 + 20 cc/kg above 20 kg</td>
</tr>
</tbody>
</table>

- Insensible water losses = cutaneous + pulmonary water losses which are calculated as ~ 300 – 500 cc/m²
- During fluid management, we should assess factors affecting insensible and/or urinary fluid losses
- Normal Na+ and K+ requirements 2 – 4 mEq/kg/day
- During fluid management, we should assess factors that affect Na and K balance
- Adding 5% dextrose to maintenance solution prevents protein catabolism
- Most commonly used solution in children:
  - D5 ½ NS + 20 mEq/L KCl or D5W/NS + 20 mEq/L KCl
  - D5 ½ NS + 20 mEq/L KCl = 4 mEq/100cc/d Na+ and 2 mEq/100cc/d K+
  - D10W: use in Neonates and Hypoglycemia
2. Deficit Replacement – Assessment Includes:

Severity:
- Represents the percentage of body weight loss, acute weight loss reflects losses of fluid and electrolytes rather than lean body mass
- Most commonly estimated based on history and physical exam
- See table on next page
- To calculate fluid deficit: % x 10 x body weight (pre-illness)

Type:
- A reflection of relative net losses of water and electrolytes based on serum Na+ or osmolality
- Important for pathophysiology, therapy and prognosis
- Affects water transport between ICC and ECC
- 70 – 80% pediatric dehydration is isotonic

<table>
<thead>
<tr>
<th>Type of Dehydration</th>
<th>Electrolyte Status</th>
<th>Clinical Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypotonic or Hyponatremic</td>
<td>Serum Na+ &lt; 130 mEq/L, Serum Osm &lt; 270</td>
<td>Exacerbated signs of dehydration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Risk of seizure</td>
</tr>
<tr>
<td>Isotonic or Isonatremic</td>
<td>Serum Na+ = 130-150 mEq/L, Serum Osm 270 – 300</td>
<td></td>
</tr>
<tr>
<td>Hypertonic or Hypernatremic</td>
<td>Serum Na+ &gt; 150 mEq/L, Serum Osm &gt;300</td>
<td>Decreased signs of dehydration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Irritable, increased tone and reflexes</td>
</tr>
</tbody>
</table>
## Assessing Dehydration: Severity

<table>
<thead>
<tr>
<th>Signs and Symptoms</th>
<th>Mild Dehydration</th>
<th>Moderate Dehydration</th>
<th>Severe Dehydration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Loss(%)</td>
<td>Infant 5 %</td>
<td>Child 10 %</td>
<td>15 %</td>
</tr>
<tr>
<td>General Appearance</td>
<td>Infant</td>
<td>Thirsty, Alert, Restless</td>
<td>Thirsty, Restless or Lethargic but Irritable or Drowsy</td>
</tr>
<tr>
<td>Infant and Young Child</td>
<td>Child 3 %</td>
<td></td>
<td>9 %</td>
</tr>
<tr>
<td>Older Child and Adults</td>
<td>Thirsty, Alert, Restless</td>
<td>Thirsty, Alert (usually)</td>
<td>Decreased LOC, Cold, Sweaty, Cyanotic extremities, Muscle cramps</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>Absent</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>Palpable Pulses</td>
<td>Present</td>
<td>Weak</td>
<td>Decreased</td>
</tr>
<tr>
<td>Respiration</td>
<td>Normal</td>
<td>Deep, may be rapid</td>
<td>Deep and rapid</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>Normal</td>
<td>Orthostatic</td>
<td>Hypotension</td>
</tr>
<tr>
<td>Fontanel / Eyes</td>
<td>Normal</td>
<td>Slightly depressed</td>
<td>Sunken</td>
</tr>
<tr>
<td>Tears</td>
<td>Present</td>
<td>Present or absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Mucous Membranes</td>
<td>Moist</td>
<td>Dry</td>
<td>Very dry</td>
</tr>
<tr>
<td>Cutaneous Perfusion</td>
<td>Normal</td>
<td>Normal</td>
<td>Decreased and mottled</td>
</tr>
<tr>
<td>Skin Turgor</td>
<td>Normal</td>
<td>Slightly decreased</td>
<td>Reduced / Tenting</td>
</tr>
<tr>
<td>Urine Output</td>
<td>Normal</td>
<td>Oliguria</td>
<td>Severe oliguria and anuria</td>
</tr>
</tbody>
</table>
FLUID MANAGEMENT IN CHILDREN (Continued)

Labs:
- Helpful in evaluation of **Type** and **Severity** of dehydration
- May need to start therapy before lab results available
- CBC for hemoconcentration, infection, source of dehydration
- Electrolytes ($\text{Na}^+$, $\text{K}^+$, $\text{Cl}^-$, $\text{HCO}_3^-$)
- BUN, Cr increased in severe dehydration
- Blood gas and $\text{HCO}_3^-$ for metabolic acidosis, may need to calculate Anion Gap (AG) = $\left[ (\text{Na}^+ + \text{K}^+) - (\text{Cl}^- - \text{HCO}_3^-) \right]$
  - Normal AG = $12 \pm 4$
- Urine R&M, concentrated urine in dehydration, infection

**Monitoring Ongoing Dehydration\Rehydration Response:**
- Clinical response to treatment
- HR, BP, Cap refill, LOC, Urine output
- As indicated: cardioresp monitor, CVP, ECG
- Labs as indicated: electrolytes, urine specific gravity, serum / urine Osm
- Repeated careful weight measurement
- Accurate INS and OUTS including stool volume & consistency

2. **Deficit Replacement – Oral Rehydration Therapy (ORT):**
- First-line treatment for Mild to Moderate dehydration
- Requires close monitoring and compliance of patient and parents
- Contains balanced amounts of sodium and glucose
- Basic treatment is replacing the deficit over 4 – 6 hours and replacing ongoing losses (eg. Diarrhea) by ORT
- Initial rates of ORT:
  - Mild: 1 cc/kg/5 mins
  - Moderate 2cc/kg/5 mins
<table>
<thead>
<tr>
<th>Solution</th>
<th>Glucose (mEq/L)</th>
<th>Na (mEq/L)</th>
<th>K (mEq/L)</th>
<th>Base (mEq/L)</th>
<th>Osmolality</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO</td>
<td>111</td>
<td>90</td>
<td>20</td>
<td>30</td>
<td>310</td>
</tr>
<tr>
<td>Rehydrate</td>
<td>140</td>
<td>75</td>
<td>20</td>
<td>30</td>
<td>310</td>
</tr>
<tr>
<td><em>Pedialyte</em></td>
<td>140</td>
<td>45</td>
<td>20</td>
<td>30</td>
<td>250</td>
</tr>
<tr>
<td>Pediatric Electrolyte</td>
<td>140</td>
<td>45</td>
<td>20</td>
<td>30</td>
<td>250</td>
</tr>
<tr>
<td>Infantlyte</td>
<td>70</td>
<td>50</td>
<td>25</td>
<td>30</td>
<td>200</td>
</tr>
<tr>
<td>Naturlyte</td>
<td>140</td>
<td>45</td>
<td>21</td>
<td>48</td>
<td>265</td>
</tr>
</tbody>
</table>
2. Deficit Replacement – Parenteral Therapy (IV):
   - Indications: Severe dehydration, patients who fail ORT due to: vomiting, refusal or difficulty keeping up with losses
   - Preferable site is IV, if unable to start IV use IO
   - Consists of 3 phases:

(i) Initial Therapy
   - Goal: expand ECF volume to prevent or treat shock
   - Solution: isotonic saline (0.9% NS or RL) in all forms of dehydration, never use hypotonic solution!!!
   - Bolus 10 – 20 cc/kg of N/S (or RL) over 15-20 mins initially, may be repeated until patient is hemodynamically stable, if unstable, call Peds 1000!
   - Rapid Rehydration (eg. 20-40 cc/kg bolus + ORT) → no evidence
   - If hypokalemic: start K⁺ when patient voids (normal renal function). Note: no K⁺ in bolus!

(ii) Subsequent Therapy
   - Goal: continue replacement of existing deficit, provide maintenance and electrolytes, replace ongoing losses
   - Solution: D5 ½ NS + 20 mEq/L KCL or D5NS + 20 mEq/L KCL in isotonic dehydration
   - Deficit Replacement Time: usually over 24 hours → ½ deficit in first 8 hours, second ½ deficit over next 16 hours
   - Subtract boluses from deficit calculation
   - Source of Electrolyte Losses: 60% ECF and 40% ICF
     - For every 100 cc water lost, electrolyte losses:
       - Na⁺: 8.4 mEq/L / 100cc
       - K⁺: 6.0 mEq/L / 100cc
       - Cl⁻: 6.0 mEq/L / 100cc

(iii) Final Therapy
   - Return patient to normal status and to normal feeding
FLUID MANAGEMENT IN CHILDREN (Continued)

3. Ongoing Losses

<table>
<thead>
<tr>
<th>Replace…</th>
<th>With…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric Losses (Vx)</td>
<td>( \frac{1}{2} ) NS + 10 – 20 mEq/L KCl</td>
</tr>
<tr>
<td>Stool or Intestinal losses (Diarrhea)</td>
<td>Add HCO(_3) to ( \frac{1}{2} ) NS + 10 – 20 mEq/L KCl</td>
</tr>
<tr>
<td>CSF losses</td>
<td>0.9% NS</td>
</tr>
<tr>
<td>Urine Output</td>
<td>As indicated</td>
</tr>
<tr>
<td>Losses due to Burns</td>
<td>Increase fluid administration (Parkland)</td>
</tr>
</tbody>
</table>

Isotonic Dehydration
- See previous steps
- Rehydrate over 24 hours

Hypotonic Dehydration
- Degree of dehydration may be overestimated
- May need immediate circulatory support
- Calculate fluid losses as above
- Calculate electrolyte losses
- Calculate Na\(^+\) to correct Na\(^+\) to 130 mEq/L using the following formula (as long as Na\(^+\) > 120 mEq/L)
  \[ (\text{Desired Na}^+ - \text{Measured Na}^+) \times 0.6 \times \text{weight (kg)} \]
- Replace losses over 24 hours (if acute losses!)
- Max increase 1 mEq/L

Hypertonic Dehydration
- Bolus by NS or RL as indicated
- Avoid electrolyte free solutions
- Calculate water and electrolyte losses
- Replace deficit slowly over 48 hours
- Monitor serum Na\(^+\) q2 – 4hours (should not fall > 0.5 mEq/L/h, max 10 mEq/L/24h) and change fluids according to Na\(^+\) drop
- Usually seize as Na\(^+\) drops, rather than as increases
- If seizures or signs of increased ICP, treat with mannitol
### Comparison of IV Solutions

<table>
<thead>
<tr>
<th>IV Solution</th>
<th>Na⁺ (mEq/L)</th>
<th>K⁺ (mEq/L)</th>
<th>Cl⁻ (mEq/L)</th>
<th>Dextrose (g/L)</th>
<th>Osmolarity (mOsm/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Chloride 0.45%</td>
<td>77</td>
<td>0</td>
<td>154</td>
<td>0</td>
<td>154</td>
</tr>
<tr>
<td>Sodium Chloride 0.9% (0.9 NaCl, NS)</td>
<td>154</td>
<td>154</td>
<td>0</td>
<td>308</td>
<td></td>
</tr>
<tr>
<td>Sodium Chloride 3%</td>
<td>513</td>
<td>0</td>
<td>1030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextrose 5%</td>
<td>0</td>
<td>50</td>
<td>250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextrose 5% Sodium Chloride 0.2%* (D5 0.2NS)</td>
<td>39</td>
<td>50</td>
<td>320</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextrose 5% Sodium Chloride 0.45% (D5 ½NS)</td>
<td>77</td>
<td>77</td>
<td>405</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextrose 5% Sodium Chloride 0.9%</td>
<td>154</td>
<td>50</td>
<td>560</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextrose 10%</td>
<td>0</td>
<td>100</td>
<td>505</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextrose 10% Sodium Chloride 0.2%*</td>
<td>39</td>
<td>100</td>
<td>575</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextrose 10% Sodium Chloride 0.45%*</td>
<td>77</td>
<td>100</td>
<td>660</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextrose 10% Sodium Chloride 0.9%*</td>
<td>154</td>
<td>100</td>
<td>813</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextrose 3.3% Sodium Chloride 0.3% (⅔ * ⅓)</td>
<td>51</td>
<td>51</td>
<td>273</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lactated Ringers†</td>
<td>130</td>
<td>4</td>
<td>109</td>
<td>0</td>
<td>273</td>
</tr>
</tbody>
</table>

†Also contains Calcium (Ca²⁺) 1.5 mmol/L, and Lactate (HCO₃⁻) 28 mmol/L
*These solutions are not commercially available
Commonly used solutions are highlighted
## Developmental Milestones

<table>
<thead>
<tr>
<th></th>
<th>Gross Motor</th>
<th>Fine Motor</th>
<th>Language</th>
<th>Social &amp; Self help</th>
<th>Red Flags</th>
</tr>
</thead>
</table>
| 0-1 month | - Moves head from side to side on stomach  
- Usually flexed posture (prone position legs are under abdomen) | - Keeps hands in tight fists  
- Brings hands within range of eyes and mouth | - Turns toward familiar sounds & voices  
- Recognizes some sounds | - Recognizes the scent of his own mother's breast milk  
- Prefers the human face to all other patterns | - Sucks poorly  
- Doesn't respond to bright lights or loud noise (blink when shown bright light)  
- Seems stiff or floppy |
| Achieved |                                                                             |                                                                             |                                                                        |                                                                                  |                                                                           |
| 2 months | - Hips not as flexed (prone position legs not under abdomen)  
- Head control improving (pull to sit) | - Hands open most of the time  
- Cooing (vowel-like sound- ooooh, ah)  
- Increases vocalization when spoken to | - Smiles | - Face is expressive | - Doesn't smile at the sound of your voice by 2 months  
- Doesn't notice her hands by 2 months  
-Not tracking objects |
| Achieved |                                                                             |                                                                             |                                                                        |                                                                                  |                                                                           |
| 3 months | - Lift head when held  
- Lift head & chest when on tummy | - Grasps and shakes hand toys  
- Holds hands open | - Chuckles  
- Begins to imitate some sounds | - Turn toward the sound of a human voice  
- Smile when smiled at | - Doesn't hold objects  
- Doesn’t smile  
- Doesn’t support head |
| Achieved |                                                                             |                                                                             |                                                                        |                                                                                  |                                                                           |
| 4 months | - No head lag in pull to sit  
- Rolls from front to back | - Reaching & grasping  
- Brings toys to mouth  
- Looks at objects in hand | - Shows excitement w/ voice & breathing  
- Increases vocalization to toys & people | - Smiles at self in mirror  
- Increases vocalization to toys & people | - Doesn't reach for and grasp toys by 3 - 4 months  
- Doesn't babble  
- Always crosses eyes |
| Achieved |                                                                             |                                                                             |                                                                        |                                                                                  |                                                                           |
| 5 months | - No head lag  
- Head steady when sitting  
- May roll back to front | - Holds two objects in both hands when placed simultaneously  
- Mimics sounds & gestures  
- 2 syllable sounds (ah-goo) | - Babbles to get your attention  
- Able to let you know if he’s happy or sad | - Babbles to get your attention  
- Able to let you know if he’s happy or sad | -Doesn’t roll over  
-Doesn’t lift head while on tummy |
| Achieved |                                                                             |                                                                             |                                                                        |                                                                                  |                                                                           |
| 6 months | - Sits w/ hands on legs (propping self up)  
- Bears full weight on legs if held standing | - Transfers object from 1 hand to the other  
- Reaches after dropped toys | - Expresses displeasure with non-crying sounds | - Knows family from strangers  
- Pats at mirror image  
- Pushes adult hand away | -Babe makes no sounds or fewer sounds, especially in response to you  
- Doesn’t reach for things |
| Achieved |                                                                             |                                                                             |                                                                        |                                                                                  |                                                                           |
| 7 months | - Bounces when held standing  
- Assumes crawling position | - Reaches with one hand  
- Bangs toys on table surface | - Begins responding to "no"  
- Starts using consonants (da, ba, ga)  
- Enjoys social play  
- Interested in mirror images | - Reaches with 1 hand only  
- One or both eyes consistently turn in or out  
- Refuses to cuddle |                                                                         |
| Achieved |                                                                             |                                                                             |                                                                        |                                                                                  |                                                                           |
| 8 months | - In sitting, reaches forward and can return to sitting up erect  
- Holds own bottle  
- Starts eating finger foods | - Responds to own name  
- Babbles chains of consonants  
- Plays peek-a-boo  
- Anticipates being picked up by raising arms | - Seems very stiff with tight muscles  
- Not babbling by 8 months |                                                                         |                                                                           |
| Achieved |                                                                             |                                                                             |                                                                        |                                                                                  |                                                                           |
### Developmental Milestones: 1 - 5 Years:

<table>
<thead>
<tr>
<th>Skill</th>
<th>12 mo</th>
<th>15 mo</th>
<th>18 mo</th>
<th>2 yrs</th>
<th>3 yrs</th>
<th>4 yrs</th>
<th>5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Walking</strong></td>
<td>Walking few steps, wide based gait, clumsy</td>
<td>Walking few steps, wide based gait, clumsy</td>
<td>Running, unstable</td>
<td>Running well</td>
<td>Broad jumps</td>
<td>Walks on tip toes</td>
<td>Skips alternating feet</td>
</tr>
<tr>
<td>Age Achieved</td>
<td></td>
<td></td>
<td>Fall if trying to pivot</td>
<td>Jumps with 2 feet on floor</td>
<td>Stands on 1 foot for 2 seconds</td>
<td>Tandem gait forward</td>
<td>Hops on 1 foot</td>
</tr>
<tr>
<td><strong>Stairs</strong></td>
<td>Creeps up-stairs</td>
<td>Creeps up-stairs w/ hand held</td>
<td>Walk up-stairs very slow &amp; careful</td>
<td>Walks up stairs alone</td>
<td>Alternates feet while walking up stairs</td>
<td>Alternates feet while walking down stairs</td>
<td>Balances on 1 foot for &gt; or equal to 10 seconds</td>
</tr>
<tr>
<td>Age Achieved</td>
<td></td>
<td></td>
<td>2 feet per step</td>
<td>2 feet per step</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gross Motor</strong></td>
<td>Stands well</td>
<td>Climbs up on a chair</td>
<td>Sit on chair</td>
<td>Kicks ball</td>
<td>Pedals tricycle</td>
<td>Stands on 1 foot for 4 seconds</td>
<td>Bicycle +/- training wheels</td>
</tr>
<tr>
<td>Age Achieved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pincer grasp</strong></td>
<td>Stacks 2 blocks</td>
<td>Stacks 3-4 blocks</td>
<td>Stacks 5-7 blocks</td>
<td>Stacks 9 blocks</td>
<td>Stacks 10 blocks</td>
<td>Does buttons up</td>
<td></td>
</tr>
<tr>
<td><strong>Fine Motor</strong></td>
<td><strong>Drawing</strong></td>
<td><strong>Age Achieved</strong></td>
<td><strong>Expressive Speech</strong></td>
<td><strong>Age Achieved</strong></td>
<td><strong>Receptive Speech</strong></td>
<td><strong>Age Achieved</strong></td>
<td><strong>Eating</strong></td>
</tr>
<tr>
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<td>------------------</td>
<td>----------------------</td>
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<td>-----------</td>
</tr>
<tr>
<td>Releases object if asked</td>
<td>Crayon in mouth Marks paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puts shapes on to board Linear scribbles</td>
<td>Circular Scribble</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imitates bridge</td>
<td>Imitates stroke</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opposes fingers to thumb in sequence</td>
<td>Copies Circle 3yrs Copies cross 3.5yrs</td>
<td></td>
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</tr>
</tbody>
</table>

**Age Achieved**

- **Drawing**
  - Crayon in mouth
  - Marks paper
  - Linear scribbles
  - Circular
  - Scribble
  - Imitates stroke
  - Copies Circle 3yrs
  - Copies cross 3.5yrs
  - Copies square
  - Copies triangle
  - Prints name

- **Expressive Speech**
  - 2-3 words
  - 5-10 words
  - 20-50 words
  - 100-200 words
  - 2-3 word combo
  - 5-8 words together
  - Past tense
  - Uses: I, me, u (pronouns)
  - Answers ‘W’ questions
  - Tells stories
  - Prepositions (behind, on, under)

- **Receptive Speech**
  - 1 command w/ gestures
  - 1 command w/o gestures
  - 5 body parts
  - 5 Common objects
  - 2 step command
  - Knows Age
  - Knows their Sex
  - Full name
  - 5-10 numbers by rote
  - Counts 10 pennies
  - 3-4 step instruction
  - Follows group direction

- **Eating**
  - Eats cheerios
  - Sipping cup
  - Spoon level, w/ solids
  - Spoon level, w/ semi-solids
  - Eats neatly
  - Eats neatly
  - Spreads peanut butter on bread

- **Dressing**
  - Plays peek-a-boo
  - Helps to remove clothes
  - Start taking off clothes
  - Takes clothes all off
  - Raise arms
  - Supervised dressing:
  - Dress alone
  - Unbuttons clothes
  - Buttons clothes up

- **Cognitive/Adaptive**
  - Kisses on request
  - Should have object permanence
  - Seeks help with effect toys
  - Use cause and effect toys
  - Parallel play
  - Folds paper
  - Unseasons tops
  - Plays simple games
  - Listens to stories
  - Group play
  - Imaginary friend
  - 4 colours
  - Knows same, biggest, tallest
  - Knows alphabet

50
### IMMUNIZATIONS

**Routine Publicly Funded Immunizations for Children in Ontario**

<table>
<thead>
<tr>
<th>Age at Vaccination</th>
<th>DPTP (Pentacel)</th>
<th>HiB</th>
<th>PneuC 7 (Prevnar)</th>
<th>MMR</th>
<th>MenC-C (Menjugate)</th>
<th>VZ</th>
<th>Hep B</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 months</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 months</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 months</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 months</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4-6 years</td>
<td>X</td>
<td>X</td>
<td>Or X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 years</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14-16 yrs</td>
<td>dTap</td>
<td></td>
<td></td>
<td></td>
<td>(if not yet given)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DPTP = Diptheria toxoid, acellular Pertussis, Tetanus toxoid, inactivated Polio vaccine; dTap = Tetanus toxoid with reduced diphtheria toxoid and acellular pertussis components (adolescent/adult type)

HiB = Haemophillus Influenza B

PneuC 7 = Pneumococcal Conjugate 7-valent vaccine

MMR = Measles, Mumps, Rubella

MenC-C = Meningococcal C Conjugate vaccine; at 14-16 years can give Conjugate or Quadrivalent A,C,Y,W135

Hep B = Hepatitis B, 2-dose schedule in Grade 7; if mother is HbsAg +ve, give HBlg and Hep B vaccine at birth, 1 month, 6 months; also follow same schedule if mother is HCV +ve

Other Vaccines : Hepatitis A (Havrix, Twinrix = combo with Hep B) = 2 vaccines 4-6 months apart for pre-exposure prophylaxis

**Note:** For premature infants, administer vaccines according to chronological or cumulative age, not corrected age
NEONATOLOGY
**St Joe’s NICU common terms and definitions list**

**A’s and B’s**- (apnea and bradycardia) defined as a cessation of breathing >20 sec or pause in breathing associated with decrease in oxygen saturation <85% or HR <100 or change in color or tone. Or just the presence of bradycardia.
Will be reported as self resolved or requiring stimulation.
Common in preterm infants however must always rule out sepsis.

**B/R**- Breast feeding.

**BLES**- Bovine surfactant, medication give for treatment of RDS (Respiratory distress syndrome) given via ETT (endotracheal tube) dose 5cc/kg. May also be used in MAS (meconium aspiration syndrome) or severe pneumonia.

**CPAP**- Continuous positive airway pressure, non invasive form of ventilation providing continuous PEEP (positive end expiratory pressure) used to keep airways open and prevent airway collapse. Used in a multitude of settings.

**CLD (chronic lung disease)**- formerly known as BPD (broncho pulmonary dysplasia) - CLD is usually defined as oxygen dependency at 36 weeks postmenstrual age (PMA) or 28 days postnatal age (PNA), in conjunction with persistent clinical respiratory symptoms and compatible abnormalities on chest radiographs.

**Gavage**- form of feeding, by where an OG tube is inserted into the stomach (placed clinically) and a feed is given by gravity or over a period of time by pump. Prior to the feed the nurse will generally draw back to see if there is any residual feed in the stomach. Reported as 0/37, scant/37 or 5/37 where the first number represents the volume of the residual and the second number the volume of the feed given. Colour of the residual is important especially when evaluating for NEC (necrotizing enterocoloitis)

**GBS**- (group B streptococcus) organism that is a common cause of neonatal infection, all women should be screened at 35-37 weeks and important to note at deliveries or on evaluation of infants < 7 days of age.

**Histogram**- continuous monitoring of oxygen saturations over 1-2 hrs, done in either prone or supine position. Reported as an average of the time period.
Reported as greater than 90 over 90, first number represents the saturation the second the percentage of the time that they over that saturation.
Normal for preterm’s 90 over 90
For preterm’s greater than 30 days and diagnosed with CLD 85 over 90.
*Normal values may vary with new research.

**IDDM**- infant of a diabetic mother can cause a multitude of neonatal complications, most commonly hypoglycemia.

**I/T ratio**- immature to total ratio, used in the evaluation of sepsis. Calculated by taking the total number of immature WBC’s (seen on manual differential) which includes, band, myelocytes, metamyelocytes, promyelocytes divided by the total number of neutrophils plus the immature WBC’s.
Immature WBC’s/total neutrophils + immature WBC’s
**IUGR** (intrauterine growth restriction) - defined as symmetric or asymmetric, if symmetric both head circumference and weight are less than the 3rd percentile if asymmetric only the weight is <3rd percentile.

**NEC (necrotizing enterocolitis)** - Gut infection, characterized by feeding intolerance, bilious residuals, abdominal distension, bloody stools, with other signs and symptoms of sepsis.

**Nippling** - synonymous with bottle feeding, reported as infant nippled 20 (infant took 20cc by bottle)

**RDS** - (Respiratory Distress syndrome) common in preterm infants or infants of IDDM (infant of a diabetic mother) due to surfactant deficiency.

**TPN** - (Total Parenteral Nutrition)- form of nutrition given by IV, contains glucose and varying amount of Na⁺, K⁺, Ca²⁺ PO₄³⁻, lipids and amino acids, generally used when infants cannot tolerate feeds.

**TFI** - (Total fluid index) volume of fluid that an infant receives per day, either enteral or parenteral. Reported in cc/kg/day. i.e. TFI of 60 cc/kg/day in a 3.0 kg term infant is: 60 x 3/24 = 10 cc/hr or 30 cc q3h

Some useful definitions and normal values for term newborns:

- Neonate: less than or equal to 28 days
- Infant: 28 days to 1 year
- Child: >1 year

**Birth**
- Average birth weight: 3.5 kg
- Average birth length: 50 cm
- Average birth head circumference: 35 cm

**Weight loss**
- Average weight loss in first week is 5-10% of birth weight
- Max weight loss in first 48 hrs: 7%
- Max weight loss in first week: 10%

**Growth**
- Return to birth weight by 14 days
- Infants double their birth weight by 5-6 months
- Infants triple their birth weight by 12 months
- Head circumference increases by 12 cm in first year of life
PROGRESS NOTE: NEONATES (LEVEL 2 NURSERY)

Date  
Time

ID:  Baby boy (surname)
Born at 33^{5/7} (i.e. 33 weeks and 5 days) gestational age
Day of life (DOL): 12
Corrected Gestational Age: 36\(^3\) wks (33^{5/7} + 12 days)
Birth weight: 2680g
   Today’s weight: 2550g (↑ 10 g from yesterday)

Brief problem list
e.g. 1. Prematurity
2. Apnea of prematurity
3. Unconjugated hyperbilirubinemia
4. Suspected NEC

   method, regurgitation/vomiting, breast feeding?
Stool/urine pattern
Other signs/symptoms you may be following (e.g. bilirubin)
Episodes of Apnea/Bradycardia? (A’s and B’s)
IV fluid/rate, urine output
Medications and other treatments (i.e. phototherapy)
Recent labs and investigations.

A: Summarize active issues. Stable? Awaiting further investigations/consult
   Differential Diagnosis

P: Outline plan by issue: include investigations, treatment, discharge plans

eg. Resolving NEC \(\rightarrow\) increase feeds slowly, starting at EBM 5cc q3h
   Jaundice \(\rightarrow\) double phototherapy, recheck bili in am.

Name, Designation (CC\PGY), Pager Number
Discussed with Dr. ________________
**NICU / L2N DISCHARGE SUMMARY TEMPLATE**

Name of person dictating:

Patient Name:

Patient Identification Number:

Admission /Transfer to L2N Date:

Discharge Date:

Copies to: Family physician

Referral physician

Follow-up pediatrician

Health records

All health care professionals involved

**Problems on Admission:**

1.

2.

3.

**Current Problems:**

1.

2.

3.

**Birth Parameters**

Gestational age: ____ weeks

Weight: ____ g (%ile)

Length: ____ cm (%tile)

Head circumference: ____cm (%ile)

**Discharge Parameters**

Corrected and chronological age: ______

Weight: ____g

Head circumference: ____cm

**Maternal History and Delivery:**

_____________ was born at McMaster University Medical Centre/elsewhere on (date) at ____ weeks gestational age to (parents’ full names). (Mother’s name) is a (age) G T P A L woman whose antenatal screens were: rubella (immune/nonimmune), VDRL (reactive/nonreactive), hepatitis B serum antigen (-/+), HIV (-/+ ___ GA), GBS (+/- at ___ GA) and blood group ___. This pregnancy was uneventful/complicated by __________. (Celestone was administered at __ weeks gestation.) Membranes ruptured ___ hours prior to delivery. The infant was born vaginally/caesarian section. Apgar scores were ___ at one minute and ___ at five minutes. (Insert post-delivery management.) He/she was appropriate/small/IUGR for gestational age with dysmorphic/ no dysmorphic features seen. The infant was admitted to the NICU/L2N and had the following problems.

Cord gases were normal, OR ____.

**If the infant had a prolonged stay in the NICU, refer here to NICU discharge summary, and do NOT repeat all these details.**

Include only applicable headings below.
**Respiratory Distress Syndrome/Bronchopulmonary Dysplasia:**
The infant received ___doses of BLES. *(Name)* was ventilated for ___ days when he/she was extubated to NPCPAP. *(Insert any complications: HFO, chest tubes, nitric oxide.)* He/she received (number) courses of dexamethasone. He/she was placed on low flow oxygen on ___ day of life. He/she is presently requiring *(therapy).* The last chest x-ray on *(date)* showed ______. The most recent blood gas shows __.

**Apnea of Prematurity:**
*(Name)* was loaded with caffeine citrate on ___ day of life. He/she is presently having ___ apneas per day/(or) is apnea free. Caffeine was discontinued on *(date).*

**Patent Ductus Arteriosus/Cardiovascular Anomalies:**
The infant was treated/not treated with a course of Indomethacin on *(date)* for a patent ductus arteriosus that presented clinically/(or) was confirmed on echocardiogram. *(Describe current status of murmur).* *(Repeat echocardiogram? Other cardiac anomalies? Follow-up?)*

**Hyperbilirubinemia:**
Mother’s blood type is ___ and infant’s blood type is ___. Serum bilirubin peaked at ___ mmol/L at ___ day of life. The infant received ___ days of phototherapy.

**Hematology:**
*(List any blood product transfusions).* The most recent CBC on *(date)* showed a hemoglobin of ___, WBC of __x 10^9/l, a platelet count of __,000 and no left shift.

**Sepsis:**
Cultures drawn following delivery were negative/(or) positive for *(name of organism).* The infant received a ___(# of days) course of *(name of antibiotics).* Due to clinical deterioration(s) the infant had a partial/(or) full septic workup(s) on *(date)* which grew *(name of organism)* and was treated with *(name of antibiotic).* *(During the neonatal course the infant had__ episodes of sepsis which were culture negative/positive (state organism(s) if identified)*

**Neurological:**
Cranial ultrasound(s) done on ___ day of life showed ___ *(include date and result of most recent ultrasound).* A follow-up ultrasound is recommended in ___ weeks.

**Retinopathy of Prematurity (ROP):**
Routine eye examinations were performed. The most recent examination on *(date)* revealed zone ___ stage ___ with no plus disease. A follow-up exam is
strongly recommended in __weeks to exclude progressive ROP. A follow-up eye appointment has been made at the eye clinic at McMaster for (date and time).

**Fluids, Electrolytes and Nutrition:**
Enteral feeds were started on __day of life and the infant achieved full enteral feeds on __day of life. Presently, the infant is receiving (TPN and/or__cc q__hourly of expressed breast milk fortified with __package of human milk fortifier to __mls of EBM (or) name of formula by gavage, breast and/or bottle) for a total fluid intake of __cc/hour. This provides __cc/kg/d or kcal/kg/d based on the current weight. On (date) the serum sodium was __mmol/L, calcium was__mmol/L, and phosphate was __mmol/L.

**Immunizations:**
1. Synagis (eligibility and date received or required and reference #).
2. Pentacel (date received or required),
3. Prevnar (date received or required).
4. Hepatitis B Immunoglobin/Vaccination (date received or required).

**Discharge Medications:** Include iron, calcium/phosphate, vitamins

**Neonatal Screens:**
1. Newborn Screen was completed on (date).
2. Hearing screen was performed on (date) as per Ministry of Health guidelines. A pass/fail was obtained for one/both ears.

(Name) is being transferred to (hospital/) under the care of (physician) until he/she can be discharged home OR (Name) is being discharged home to the care of his parents/foster parents.

**Follow-up**
The infant requires follow-up for retinopathy of prematurity and cranial ultrasounds as well as (indicate any follow-up required including growth and development, appointments, etc.)

Thank you for accepting the care of this infant.

Name, Designation (CC\PGY), Pager Number
Dictating For Dr. (Name of Paediatrician/Neonatologist)
Overview of Resuscitation in the Delivery Room

Birth

Term Gestation? Clear Amniotic Fluid? Breathing or Crying? Good Muscle Tone?

Yes

Routine Care

Provide Warmth Clear Airway* (As Necessary) Dry, Stimulate, Reposition

No

30 sec

Provide Warmth Position; Clear Airway* (As Necessary) Dry, Stimulate, Reposition

Approximate Time

Evaluate Respirations, Heart Rate and Colour

Breathing

HR > 100 Pnk

Observational Care

Pnk

Cyanotic

Give Supplemental Oxygen

Pnk

Persistently Cyanotic

Effective Ventilation

HR > 100 Pnk

Post-Resuscitation Care

30 sec

Provide Positive-Pressure Ventilation**†

HR < 60

HR > 60

Provide Positive-Pressure Ventilation*

Administer Chest Compressions*

Administer O₂ after 90 sec if no improvement in colour or HR

30 sec

Give Epinephrine*

HR < 60

* Endotracheal intubation may be considered at several steps
† Use room air with positive pressure ventilation

Adapted from Circulation 2005;112;III-51-59.
For use at McMaster Children’s Hospital & St. Joseph’s Healthcare, Hamilton, Ontario
<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>1 kg &lt; 30 weeks</th>
<th>2 kg 30-36 weeks</th>
<th>3 kg &gt; 36 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Epinephrine</strong></td>
<td>IV Route (Preferred)</td>
<td>0.1 ml</td>
<td>0.2 ml</td>
<td>0.3 ml</td>
</tr>
<tr>
<td>1:10,000 0.1 mg/ml</td>
<td>(0.01 mg/kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>q3-5 minutes</td>
<td>ETT Route (0.1 mg/kg)</td>
<td>1 ml</td>
<td>2 ml</td>
<td>3 ml</td>
</tr>
<tr>
<td><strong>Sodium Bicarbonate</strong></td>
<td>4.2% IV 0.5 mmol/ml (2 mmol/kg) For Prolonged Arrest</td>
<td>4 ml</td>
<td>8 ml</td>
<td>12 ml</td>
</tr>
<tr>
<td><strong>Naloxone</strong></td>
<td>IV or IM 0.4 mg/ml (0.1 mg/kg) Contraindicated in narcotic dependent mothers</td>
<td>0.25 ml</td>
<td>0.5 ml</td>
<td>0.75 ml</td>
</tr>
<tr>
<td><strong>Volume Expanders</strong></td>
<td>Normal Saline (NS, 0.9 NaCl) Packed Red Blood Cells</td>
<td>10 ml</td>
<td>20 ml</td>
<td>30 ml</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 ml</td>
<td>20 ml</td>
<td>30 ml</td>
</tr>
<tr>
<td><strong>Glucose (D10W)</strong></td>
<td>IV Bolus 200 mg/kg For documented hypoglycemia</td>
<td>2 ml</td>
<td>4 ml</td>
<td>6 ml</td>
</tr>
</tbody>
</table>
### NICU NUTRITION GUIDELINES

#### ENTERAL FEEDING IN NICU

**Method of Feeding (By Age)**

<table>
<thead>
<tr>
<th></th>
<th>&lt; 32 weeks</th>
<th>32-34 weeks</th>
<th>34-36 weeks</th>
<th>36-40 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gavage</td>
<td>Yes</td>
<td>Yes</td>
<td>If indicated</td>
<td>Not usually</td>
</tr>
<tr>
<td>Breast Bottle</td>
<td>Individual Assessment</td>
<td>1-2 q shift</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-2 q shift</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Ad lib</td>
<td></td>
<td>Minimum feed Vol (cc)/ Time (hr)</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

#### FEEDING HUMAN MILK IN NICU

**Human milk is the Feeding of Choice for All Infants in NICU**

**Expressed Breast Milk (EBM)**

All infants should be established on feeds of EBM when available. If EBM is not available or not indicated then formula may be used either as a supplement to EBM or as the sole source of nutrition.
## NICU NUTRITION GUIDELINES (CONTINUED)

### ENTERAL FEEDING IN NICU

#### Initiation and Advancement of Enteral Feeds (By Birth Weight and Age)

#### Infants < 1500 grams:

<table>
<thead>
<tr>
<th>Birth Weight/Age</th>
<th>Initiate Trophic Feeds:</th>
<th>Amount/ Frequency:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 750 grams</td>
<td>By 24-48 hr of age</td>
<td>1 cc q 4 hr x 2 d</td>
</tr>
<tr>
<td>750 – 999 g &gt; 26 weeks</td>
<td>By 24-48 hr of age</td>
<td>1 cc q 2 hr x 2 d</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Birth Weight/Age</th>
<th>Nutritional Feeds/Timing</th>
<th>Amount/ Frequency:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1250 - 1499 g &gt; 28 weeks</td>
<td>At 72-96 hr of age</td>
<td>1 cc q 2 hr</td>
</tr>
<tr>
<td>1000 - 1249 g &gt; 27 weeks</td>
<td>At 72-96 hr of age</td>
<td>1 cc q 2 hr</td>
</tr>
</tbody>
</table>

**Increase:**
- 1 cc q 24 hr
- 1 cc q 24 hr x 2 d
- 1 cc q 12 hr

#### Infants > 1500 grams

<table>
<thead>
<tr>
<th>Birth Weight/Age</th>
<th>Timing:</th>
<th>Amount/ Frequency:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500 - 1750 g &gt; 29 weeks</td>
<td>Day 1 / Stable</td>
<td>3 mL q 3 hr</td>
</tr>
<tr>
<td>1750 - 1999 g &gt; 30 weeks</td>
<td>Day 1 / Stable</td>
<td>6 – 9 mL q 3 hr</td>
</tr>
<tr>
<td>2000 - 2499 g &gt; 31 weeks</td>
<td>Day 1 / Stable</td>
<td>9 – 12 mL q 3 hr</td>
</tr>
<tr>
<td>&gt; 2500 g &gt; 34 weeks</td>
<td>Day 1 / Stable</td>
<td>12 – 15 mL q 3 hr or Ad lib</td>
</tr>
</tbody>
</table>

**Increase:**
- 3 mL q 9 hr
- 3 mL q 6 hr
- 3 mL q 3 hr
- 6 mL q 3 hr

**Management of Residuals:** See Feeding Practice Guidelines in Resource Binder
NICU NUTRITION GUIDELINES (CONTINUED)

FEEDING HUMAN MILK IN NICU

Expressed Breast Milk (EBM) + Similac Human Milk Fortifier

Initiate Fortification:
- When infant tolerating full volume feeds for approx. 48 hours and approx. 2 weeks of age

Dosing:
- Initially → 1 package fortifier per 100 mL EBM
- Increase → 1 package fortifier per 50 mL EBM after 48 hours
- Increase → 1 package fortifier per 25 mL EBM (maximum dose) for infants < 1200 g birth weight or infants not growing well

Continue Fortification:
- Until infant reaches at least 2.0 kg or is established at breastfeeding
- May be used for longer periods in nutritionally compromised infants
  - Until infant reaches at least 2.5 kg if growing well then reduce fortifier to 1:50
- If birth weight < 1200 g or BPD
  - Until infant reaches at least 3.0 kg or until discharged and consider supplemental Neosure post-discharge
NICU NUTRITION GUIDELINES (CONTINUED)

FEEDING HUMAN MILK IN NICU

Formula Selection

<table>
<thead>
<tr>
<th>Infant Age or Weight</th>
<th>Formula Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 34 weeks OR &lt; 2.0 kg</td>
<td>Similac Special Care (SSC) 24</td>
</tr>
<tr>
<td>Once weight 2200 – 2500 g switch to</td>
<td>Term Formula*</td>
</tr>
<tr>
<td>If weight remains &lt; 10 % consider</td>
<td>Similac Advance Neosure</td>
</tr>
<tr>
<td>If birth weight &lt; 1200 g or BPD use</td>
<td>Preterm Formula</td>
</tr>
<tr>
<td>Until Discharge or 3.0 kg then switch</td>
<td>Neosure</td>
</tr>
<tr>
<td>&gt; 34 weeks OR ≥ 2.0 kg birth weight</td>
<td>Term Formula*</td>
</tr>
</tbody>
</table>

*Term Formulas: Similac Advance, Enfamil A+, Goodstart
Parents may choose formula they wish to use

Nutrient Composition of Fortified Human Milk / SSC 24/100 mL

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Unfortified</th>
<th>Fortified 1:50</th>
<th>Fortified 1:25</th>
<th>SSC 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal/100 mL)</td>
<td>70</td>
<td>77</td>
<td>84</td>
<td>80</td>
</tr>
<tr>
<td>Protein – g</td>
<td>1.3</td>
<td>1.85</td>
<td>2.3</td>
<td>2.4</td>
</tr>
<tr>
<td>Calcium - mmol</td>
<td>0.5</td>
<td>1.98</td>
<td>3.45</td>
<td>3.1</td>
</tr>
<tr>
<td>Phosphorus – mmol</td>
<td>0.4</td>
<td>1.43</td>
<td>2.52</td>
<td>2.3</td>
</tr>
<tr>
<td>Vitamin A – IU</td>
<td>363</td>
<td>670</td>
<td>983</td>
<td>814</td>
</tr>
<tr>
<td>Vitamin D – IU</td>
<td>-</td>
<td>60</td>
<td>119</td>
<td>122</td>
</tr>
<tr>
<td>Sodium – mmol</td>
<td>1.0</td>
<td>1.3</td>
<td>1.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Potassium - mmol</td>
<td>1.4</td>
<td>2.2</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Iron – mg</td>
<td>0.11</td>
<td>0.29</td>
<td>0.46</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Note: Max. protein intake with normal renal function 4 g/kg/day

Vitamin / Mineral Supplements using Similac HMF:
1:50: Poly-Vi-Sol 0.5 mL daily; Iron as per guidelines
1:25: Poly-Vi-Sol 0.5 mL daily until weight 1.8 kg; Fe as per guidelines
NICU NUTRITION GUIDELINES (CONTINUED)

TOTAL PARENTAL NUTRITION (TPN) IN NICU – SUMMARY GUIDELINES

Starting TPN
Infants < 1500 g → Start on modified TPN
Neostarter (D10W + Protein + Calcium @ 50 cc/kg/day) on Day 1 and TPN by 48 hours of age
Infants > 1500 g → Start on TPN by 48-72 hr of age if NOT expected to be enterally fed by 72 hr

Stopping TPN: TPN may be discontinued when an infant is tolerating 75% of full enteral feeds

Writing TPN Orders
• Determine total fluid available for TPN. (*Total fluid intake minus fluid for IV lines / medications*)
• Determine flow rate required to provide desired amount of lipid (see summary).
• The remaining fluid should be used for amino acid / dextrose solution

Monitoring TPN (TPN) Bloodwork
For infants who have been on TPN > 48 hours; Every Tuesday (‘Week’ represents week of the month)

<table>
<thead>
<tr>
<th>Lab</th>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrolytes: Na, K</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>Glucose*</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>Triglycerides</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>Urea / Creat</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ca / P</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bili</td>
<td></td>
<td>x</td>
<td>x</td>
<td>X</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>AST / ALT</td>
<td></td>
<td>x</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Every Friday: electrolytes (Na, K), Glucose*, Triglycerides (until tolerating full dose)
Trace Elements: if on long term TPN, once direct bili > 50 mmol/L send serum for trace elements (Zn, Cu, Se, Mn) – 0.6 mL
Ferritin: Infants > 6 weeks of age on TPN, check serum ferritin before adding iron
*send urine for glucose if PCX > 9 mmol/L
NICU NUTRITION GUIDELINES (CONTINUED)

TOTAL PARENTAL NUTRITION (TPN) IN NICU – SUMMARY GUIDELINES

(A) Macronutrients

Dextrose

<table>
<thead>
<tr>
<th>Prescription</th>
<th>mg/kg/min</th>
<th>g/kg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial dose</td>
<td>4 – 6</td>
<td>6 - 9</td>
</tr>
<tr>
<td>Average Daily Increase</td>
<td>0.5 - 1.0</td>
<td>0.7 - 1.4</td>
</tr>
<tr>
<td>Maximum dose</td>
<td>11 – 13</td>
<td>16 - 19</td>
</tr>
</tbody>
</table>

Energy Value: 3.4 kcal/g
Conversions: 1 mmol = 0.2 g = 200 mg
Comments: For peripheral parenteral nutrition, the osmolar load from dextrose should not exceed 500 mmol/L (D10W) unless necessary to maintain euglycemia

Protein

<table>
<thead>
<tr>
<th>Prescription</th>
<th>g/kg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source: Primene 10%</td>
<td></td>
</tr>
<tr>
<td>Initial dose *</td>
<td>1.5</td>
</tr>
<tr>
<td>Avg. daily increase</td>
<td>1.0</td>
</tr>
<tr>
<td>Maximum usual dose</td>
<td>3.0 - 3.5**</td>
</tr>
</tbody>
</table>

Energy Value: 5.2 kcal/g; 21.8 kJ/g
For infants < 1500 g → Start on modified TPN → Neostarter (D10W + Protein + Calcium @ 50 cc/kg/day) on Day 1 and TPN by 48 hours of age, with other IVs
**3 g/kg/day acceptable for term infants
Monitor / reassess maximum protein dose:
- Renal Failure
- Hepatic Failure
- Elevated Serum Urea
TOTAL PARENTAL NUTRITION (TPN) IN NICU – SUMMARY GUIDELINES

(A) Macronutrients (Continued)

Lipid

<table>
<thead>
<tr>
<th>Prescription Source: Intralipid 20%</th>
<th>Birth Weight &lt; 750 g</th>
<th>Birth Weight &gt;750 g</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Dose (g/kg/day)</strong></td>
<td>By 48 hr of age</td>
<td>By 48 hr of age</td>
</tr>
<tr>
<td></td>
<td>0.5 - 1.0</td>
<td>0.5 - 1.0</td>
</tr>
<tr>
<td><strong>Average Daily Increase</strong> (g/kg/day)</td>
<td>After 48-72 hr on initial dose</td>
<td>0.5 - 1.0</td>
</tr>
<tr>
<td></td>
<td>0.5 (or 1.0 q other day)</td>
<td></td>
</tr>
<tr>
<td><strong>Maximum Dose (1)</strong> (g/kg/day)</td>
<td>3.0 - 3.5</td>
<td>3.0 - 3.5</td>
</tr>
</tbody>
</table>

Energy Value: 20% - 2 kcal / mL; 8.4 kJ / mL
Conversions: 20% - 0.21 g fat / mL
Cautions:
- For infants with worsening acute lung disease or hyperbilirubinemia (unconjugated), hold lipid at 0.5 - 1.0 g/kg/day until clinical condition improves
- Sepsis - decreased lipid to 1 g/kg/day for first 24 - 48 hr and then increase as tolerated to full rates

Monitor / reassess:
- Triglycerides (TG) every Tuesday and Friday until tolerating maximum dose, then every Tuesday
  Interpretation: TG < 1.7 desirable; TG < 2.2 acceptable
Actual requirements for sodium may be significantly higher in the first two weeks of life, depending on urinary losses.

Due to the limits of solubility of calcium and phosphorus in amino acid solutions, the maximum dose of 15 mmol of calcium and phosphorus per litre of amino acid solution can only be attained if the total amino acid concentration is 30 g/L or higher. Otherwise, precipitation of calcium and phosphorus may occur.

Caution: do not add phosphorus to TPN unless there is at least 1 g/kg amino acids added to the solution. Normal molar ratio of Ca:P is 1:1. Use caution if unequal amounts of calcium and phosphorus added to TPN solution.

<table>
<thead>
<tr>
<th>Minerals (Maintenance intakes for stable, growing infants)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Sodium</td>
</tr>
<tr>
<td>Potassium</td>
</tr>
<tr>
<td>Magnesium</td>
</tr>
<tr>
<td>Calcium</td>
</tr>
<tr>
<td>Phosphorus</td>
</tr>
</tbody>
</table>

Vitamins
Source: MVI Paediatric (MVI Ped)
Dosage: By pharmacy, on weight (Initiate at 48 hr of age)

Trace Elements
Source:

<table>
<thead>
<tr>
<th>mcg / mL</th>
<th>Zinc</th>
<th>Copper</th>
<th>Selenium</th>
<th>Chromium</th>
<th>Manganese</th>
<th>Iodine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neo Trace Element Mix</td>
<td>425</td>
<td>19</td>
<td>2</td>
<td>0.2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Liver Mix*</td>
<td>425</td>
<td>10</td>
<td>2</td>
<td>0.2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

*To be used when direct bilirubin > 50 mmol/L; Send blood for trace elements when changed to Liver Mix
Dosage: 1 mL/kg (Maximum: 3 mL)

Iron: 0.1-0.2 mg/kg (Initiate at 6 weeks of age for infants on TPN if ferritin <500)
## NICU NUTRITION GUIDELINES (CONTINUED)

### VITAMIN/MINERAL SUPPLEMENTS IN NICU – SUMMARY GUIDELINES

<table>
<thead>
<tr>
<th>Vitamins</th>
<th>Feeding</th>
<th>Poly-vi-sol</th>
<th>D-Vi-Sol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm Infants In Hospital (&lt; 2000 grams)</td>
<td>Unfortified EBM</td>
<td>0.5 mL BID</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Fortified (1:25) EBM</td>
<td>0.5 mL daily until weight 1.8 kg</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>SSC 24</td>
<td>0.5 mL daily until weight 1.8 kg</td>
<td>None</td>
</tr>
<tr>
<td>Term Infant</td>
<td>EBM</td>
<td>None</td>
<td>1.0 mL OD</td>
</tr>
<tr>
<td></td>
<td>Formula</td>
<td>none</td>
<td>None</td>
</tr>
<tr>
<td>Preterm Infants After Discharge Home</td>
<td>Human Milk or Regular Infant Formula</td>
<td>Intake &lt; 800 mL/day – 0.5-1.0 mL daily</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intake &gt; 800 mL/day - none</td>
<td>1.0 mL OD (human milk only)</td>
</tr>
</tbody>
</table>

1.0 mL Poly-Vi-Sol contains: 10 ug (400 IU) Vitamin D, 450 ug (1500 IU) Vitamin A, 30 mg Vitamin C, 0.5 mg Thiamin, 4.0 mg Niacin, 0.6 mg Riboflavin

1.0 mL D-Vi-Sol contains: 400 IU Vitamin D

### Iron (Fe)

<table>
<thead>
<tr>
<th>Prescription: Ferrous Sulfate (1.0 mL = 15 mg elemental Fe)</th>
<th>Preterm infants in hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>@ 4-6 weeks of age:</td>
</tr>
<tr>
<td></td>
<td>&lt; 1 kg</td>
</tr>
<tr>
<td></td>
<td>≥ 1 kg &amp; &lt; 2 kg</td>
</tr>
<tr>
<td></td>
<td>≥ 2 kg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prescription: Fer-In-Sol (Mead Johnson) (1.0 mL = 15 mg elemental Fe)</th>
<th>Preterm Infants after discharge (See Notes below)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 3-4 kg</td>
</tr>
<tr>
<td></td>
<td>&gt; 3-4 kg</td>
</tr>
</tbody>
</table>

1. P-RNI for iron: 2-4 mg/kg/day up to max. 15 mg elemental iron given as ferrous sulfate supplement or iron fortified formula. (Birth Weight < 1 kg: 3-4 mg/kg/day; ≥ 1 kg: 2-3 mg/kg/day)
2. Prescription amounts above are given as elemental iron (check dosage on product used). (1 mg elemental iron =5 mg total iron)
ALL Women Receive a Vaginal and Rectal GBS Culture at 35-37 Weeks' Gestation*

<table>
<thead>
<tr>
<th>Intrapartum Antibiotic Prophylaxis</th>
<th>Indicated:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOT Indicated:</td>
<td>• Previous pregnancy with a Positive GBS screening culture and a Negative screen during current pregnancy</td>
</tr>
<tr>
<td></td>
<td>• Planned C/S delivery performed without onset of labor or membrane rupture</td>
</tr>
<tr>
<td></td>
<td>• Negative GBS screening culture, regardless of intrapartum risk factors</td>
</tr>
<tr>
<td></td>
<td>• Previous infant with invasive GBS disease (*no GBS screen required)</td>
</tr>
<tr>
<td></td>
<td>• GBS bacteriuria during current pregnancy (*no GBS screen required)</td>
</tr>
<tr>
<td></td>
<td>• Positive GBS screen culture during current pregnancy (unless planned C/S)</td>
</tr>
<tr>
<td></td>
<td>• Unknown GBS Status AND any of the following risk factors:</td>
</tr>
<tr>
<td></td>
<td>o Delivery at &lt; 37 weeks gestation</td>
</tr>
<tr>
<td></td>
<td>o Membrane rupture for ≥ 18 hours (during labor)</td>
</tr>
<tr>
<td></td>
<td>o Intrapartum fever ≥ 38°C ♣</td>
</tr>
</tbody>
</table>

* No GBS screen required if a woman had GBS bacturia during the current pregnancy or a previous infant with invasive GBS disease

♣ If amnionitis suspected, broad-spectrum antibiotic therapy, including an agent known to be active against GBS, should replace GBS prophylaxis

Section References
PREVENTION OF PERINATAL GROUP B STREPTOCOCCAL (GBS) DISEASE (CONTINUED)\(^1\)

GBS Prophylaxis for Women < 37 weeks gestation with:
- Onset of Labor or Rupture of Membranes and
- Significant risk for imminent/threatened preterm delivery

<table>
<thead>
<tr>
<th>No GBS Culture</th>
<th>GBS (+ve) Positive</th>
<th>GBS (-ve) Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain GBS Culture</td>
<td>IV Antibiotics for ≥ 48 hours* during tocolysis</td>
<td>No GBS Prophylaxis *</td>
</tr>
<tr>
<td>GBS (-ve) Negative After 48 Hours</td>
<td>Stop Antibiotics*</td>
<td>Intrapartum Antibiotic Prophylaxis</td>
</tr>
</tbody>
</table>

*Antibiotics should be continued for a total of at least 48 hours, unless delivery occurs sooner. At the physician’s discretion, antibiotic prophylaxis may be continued beyond 48 hours in a GBS culture positive woman if delivery has not yet occurred. For women who are GBS culture positive, antibiotics should be reinitiated when labor that is likely to proceed to delivery occurs.

* If delivery has not occurred within 4 weeks, a vaginal and rectal GBS screening culture should be repeated and the patient managed based on the result of the repeat culture.
**PREVENTION OF PERINATAL GROUP B STREPTOCOCCAL (GBS) DISEASE (CONTINUED)**

Management of the Newborn

Maternal Intrapartum Antibiotic Prophylaxis (IAP) Use For GBS + ve Mother

- **Yes**
  - Signs of Neonatal Sepsis?
    - **Yes**
      - Consider CBC at 4 hours
    - **No**
      - Gestational Age
        - **≥ 35 Weeks**
          - Duration of IAP Before Delivery
            - **< 4 Hours**
              - No Evaluation No Therapy
            - **≥ 4 Hours**
              - Limited Evaluation
                - Observe ≥ 48 hours
                - If Sepsis is Suspected:
                  - Full Diagnostic Evaluation
                  - Empiric Therapy
        - **< 35 Weeks**
          - Yes
            - Consider CBC at 4 hours
          - No
            - Maternal Antibiotics for Suspected Chorioamnionitis?
              - **Yes**
                - Full Diagnostic Evaluation
                - Empiric Therapy
              - **No**
                - CBC with differential at 4 hours and blood C&S

Recommended Antibiotics for GBS Prophylaxis

- **Recommended**
  - Penicillin G 5 million Units IV STAT then 2.5 million Units IV q4h until delivery
Alternative
Ampicillin 2g IV STAT then 1g IV q4h until delivery

If Penicillin-Allergic $\rightarrow$ Determine Risk for Anaphylaxis:

If Low Risk for Anaphylaxis
Cefazolin 2g IV STAT then 1g IV q8h until delivery

If High Risk for Anaphylaxis
Criteria:
- Have experienced immediate hypersensitivity to penicillin including a history of penicillin related anaphylaxis OR
- Asthma or other diseases that would make anaphylaxis more dangerous to treat (eg. Being treated with $\beta$-Blocker)

Then Determine Susceptibility to Clindamycin and Erythromycin on Prenatal GBS Isolated $\rightarrow$

If GBS susceptible to Clindamycin and Erythromycin:
Clindamycin 900 mg IV q8h until delivery
OR
Erythromycin 500 mg IV q6h until delivery

If GBS resistant to Clindamycin and Erythromycin OR Susceptibility Unknown:
Vancomycin 1g IV q12h until delivery
  - Reserved for Penicillin-Allergic women at High Risk for Anaphylaxis
HYPOGLYCEMIA GUIDELINES FOR THE AT-RISK NEWBORN

Signs and Symptoms of Hypoglycemia:
- Jitteriness, tremors
- Episodes of cyanosis
- Convulsions
- Apnea
- Tachypnea
- Weak or high-pitched cry
- Limpness, lethargy, hypotonia
- Difficulty feeding, refusal to feed
- Eye rolling
- Sweating, sudden pallor
- Cardiac arrest

Risk Factors for Hypoglycemia
- Maternal hypertension treated with beta-blockers
- Any maternal diabetes (gestational, Type I or II, with or without insulin)
- Preterm – less than 37-0/7 weeks
- Cold stress – Hypothermia: Temp (Axillary) < 36.5 °C
- Newborns with medical conditions (eg. respiratory distress, sepsis)
- SGA < 5th percentile for birth weight and gestational age
- LGA > 95th percentile for birth weight and gestational age

<table>
<thead>
<tr>
<th>Gestation (completed weeks)</th>
<th>Male Weight in gm</th>
<th>Female Weight in gm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SGA &lt; 5th percentile</td>
<td>LGA &gt; 95th percentile</td>
</tr>
<tr>
<td>36</td>
<td>Less than or equal to 2144</td>
<td>Greater than or equal to 3604</td>
</tr>
<tr>
<td>37</td>
<td>Less than or equal to 2384</td>
<td>Greater than or equal to 3857</td>
</tr>
<tr>
<td>38</td>
<td>Less than or equal to 2605</td>
<td>Greater than or equal to 4065</td>
</tr>
<tr>
<td>39</td>
<td>Less than or equal to 2786</td>
<td>Greater than or equal to 4232</td>
</tr>
<tr>
<td>40</td>
<td>Less than or equal to 2927</td>
<td>Greater than or equal to 4382</td>
</tr>
<tr>
<td>41</td>
<td>Less than or equal to 3025</td>
<td>Greater than or equal to 4512</td>
</tr>
<tr>
<td>42</td>
<td>Less than or equal to 3070</td>
<td>Greater than or equal to 4631</td>
</tr>
</tbody>
</table>

References:
Kramer et al. (2001). It is recognized that these weights deviate from the CPS Guidelines (2005) of the 10th and 90th percentile cut-offs for birth weight at term.
ACoRN – Acute Care of at-Risk Newborns. (2005)
Note:
1. Ongoing newborn assessment and timely interventions should not be limited by these guidelines. If at any point the newborn is symptomatic or otherwise unwell, notify the Family Physician or Midwife who may then choose to consult a Pediatrician.
2. If baby is unable to feed at any point in these guidelines, notify the Family Physician or Midwife. He/she will then assess the need for consult/transfer of care to a Pediatrician.
* When the need for MD Protocol A or B arises, if not already in place, the Family Physician or Midwife will consult/transfer care to a Pediatrician.

Legend:
MD = Medical Doctor, MW = Midwife
EBM = Expressed Breast Milk
IDM = Infant of a Diabetic Mother
AC = before feeds, PC = after feeds
cbG = capillary blood glucose, measured by glucose meter
bG = Blood glucose, venous sample sent to laboratory
** preferred = breastfeed or formula feed baby depending on which method mom has chosen to feed baby
MD Protocol A

Start Infusion with D10W @ 80cc/kg/day (5.5 mg glucose/kg/min)

Check WBG after 30 Minutes

- **WBG < 1.8**: Go to MD protocol B
- **WBG 1.8-2.5**: Increase IV infusion to 6-8 mg/kg/min, Check BG in half hour, then every 2 hours. May start to wean IV 12 hours after stable BG is and feeding established.
- **WBG ≥ 2.6**: Continue checking BG every 2 hours. May start to wean IV 12 hours after stable WBG and feeding is
MD Protocol B

Consider 200mg/kg (2cc/kg) D10W bolus, IV infusion of 6-8 mg/kg/min

Recheck WBG in ½ hour

BG < 1.8

Bolus 200mg/kg (2cc/kg) D10W and Increase infusion to 8-10 mg/kg/min

Recheck BG in ½ hour, then hourly, May wean IV once BG stable for 12 hours

BG > 2.6

Increase infusion to 8-10 mg/kg/min

Continue checking BG every 2 hours. May start to wean IV 12 hours after stable BG and feeding is established.

BG 1.8-2.5

Consider glucagon and increase infusion to 10-15 mg/kg/min if continued low WBG
Remember for care of baby in NICU or SCN

- Frequent boluses of D10W will induce an insulin surge and rebound hypoglycemia. It is recommended that a maximum of 2 boluses of D10W be used.

- Consider daily maintenance of fluid. Once reaching 120 cc/kg/day, in the first 24 hours of life, consider switching to D12.5W/D15W in order to increase glucose concentration but maintain fluid status. A central line must be used when infusing glucose > D12.5W.

- When considering glucagon, think hypopituitarism, hyperinsulinism or a metabolic defect. When the blood sugar is < 1.8mmol/l, get a critical sample of glucose, insulin, GH, cortisol, T4, TSH, gas, lactate and urinary ketones also consider plasma ketones, pyruvate, FFA, organic and amino acids prior to starting glucagon.

- Glucagon 0.3 mg/kg/dose bolus not to exceed 1 mg total dose OR continuous infusion of 1mg/day (to a maximum of 2mg/day). Add 1 mg to 24 ml of D10W and run at 1ml/hour through a separate IV line.

- Glucose monitoring should be q ½ hour to q1hour until stable then q3-4hours.

- May start weaning IV 12 hours after stable BG and feeding is established. When weaning glucose, wean slowly. Wean the concentration of the glucose to D10W first, which will decrease the rate of glucose infused then wean the rate to 4-6mg/kg/min (1cc q1-4hours depending on the initial severity of the hypoglycemia) and finally the glucagon. Wean glucagon 0.1cc every 6-12 hours depending on the initial severity of the hypoglycemia.

- If hypoglycemia is resistant to treatment or unable to wean off the glucagon, consult endocrinology before instituting further therapies. Consider Diazoxide 8-15 mg/kg/day p.o. TID -QID Hydrocortisone 5 mg/kg/day IV QID or Prednisone 2mg/kg/day p.o..

- Remember severe and persistent hypoglycemia may be associated with a significant risk for short and long-term morbidity and mortality. Thus prompt recognition and treatment is essential.

\[
\begin{align*}
\text{D10W} &= 10 \text{ gms} / 100\text{ml} \\
&= 10,000\text{mg} / 100\text{ml} \\
&= 100\text{mg} / \text{ml}
\end{align*}
\]

**Example:**
To give a 3 kg child 5 mg / kg / min
1. 5mg / kg / min x 3 kg = 15 mg / min
2. 15 mg / min x 60 min = 900 mg / hour
3. D10W has 100 mg / ml, so 900 mg / hour = 9 cc / hour
4. Therefore, to give a child of 3 kg, 5 mg / kg / min of glucose, run D10W at 9 cc / hour.
HYPERBILIRUBINEMIA (JAUNDICE) IN THE NEWBORN INFANT ≥ 35 WEEKS OF GESTATION

Primary Prevention
- Promote and support successful breastfeeding. Breastfeeding is not contraindicated in the presence of jaundice; more frequent breastfeeding may be beneficial. **Exception:** high probability of exchange transfusion.
- Do not supplement breastfed infants with water or dextrose. There is no evidence that excessive fluid administration affects serum bilirubin concentration unless the infant is dehydrated.

Secondary Prevention
- Clinical Assessment for jaundice q8-12h with vitals
- However, recognize visual estimation of the degree of jaundice can lead to errors, particularly in darkly pigmented infants and is not recommended

If Jaundiced Inpatient → Evaluation and Investigations:
**Note:** These are mandatory for hyperbilirubinemia requiring phototherapy

<table>
<thead>
<tr>
<th>History</th>
<th>Physical Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>description of labour and delivery</td>
<td>extent of jaundice/pallor</td>
</tr>
<tr>
<td>infant’s clinical course</td>
<td>bruising/cephalhematomas</td>
</tr>
<tr>
<td>feeding regimen, sleep/lethargy</td>
<td>polycythemia</td>
</tr>
<tr>
<td>stool, urine frequency</td>
<td>weight loss/hydration</td>
</tr>
<tr>
<td>family history/ethnicity</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Laboratory</th>
<th>Consider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum bilirubin concentration and conjugated bilirubin</td>
<td>sepsis</td>
</tr>
<tr>
<td>complete blood count and differential</td>
<td>reticulocyte count screen</td>
</tr>
<tr>
<td>blood smear for red cell morphology</td>
<td>G6PD Screen</td>
</tr>
<tr>
<td>blood group and direct antibody test</td>
<td>Coombs’ test, if indicated</td>
</tr>
<tr>
<td></td>
<td>serum electrolytes, albumin/protein</td>
</tr>
<tr>
<td></td>
<td>TSH, Galactosemia screen</td>
</tr>
</tbody>
</table>

- If jaundice persists > 7 days and not improving, or conjugated bilirubin > 20% of the total bilirubin, **consult with a specialist.**
- Measure the total bilirubin on all infants jaundiced in the first 24 hours and consider consult with a specialist since jaundice occurring < 24 Hours of age is considered “pathologic” until proven otherwise
HYPERBILIRUBINEMIA: Secondary Prevention
(IN THE NEWBORN INFANT ≥ 35 WEEKS OF GESTATION)

Assessment Before Discharge

Before discharge every newborn should be assessed for risk of developing hyperbilirubinemia. The bilirubin nomogram for follow up of babies can be very helpful if a bilirubin has been done prior to discharge.

Risk of developing hyperbilirubinemia in infants 35 or more weeks of gestation:

Major Risk Factors:

Predischarge bilirubin in the high risk zone
Jaundice observed in the first 24 hours
Hemolysis due to ABO incompatibility or other causes
Gestational age 35-36 weeks
Previous sibling received phototherapy
Cephalhematoma or significant bruising
Exclusive breast-feeding, particularly if nursing is not going well and there is excessive weight loss
East Asian race

Minor Risk Factors:

Predischarge bilirubin in the high intermediate risk zone
Gestational age 37-38 weeks
Jaundice observed before discharge
Previous sibling received phototherapy
Macrosomic infant of a diabetic mother
Maternal age > 25 years
Male gender

There should be heightened vigilance for clinical or visual signs and symptoms of jaundice if the baby has any Major Risk Factors for severe hyperbilirubinemia
Sixty percent of term infants will become clinically jaundiced in the first week of life. In the vast majority of cases, neonatal jaundice is physiologic, mild, benign, self-limiting and normal. This "normal" form of neonatal jaundice has been referred to as "physiological jaundice of the newborn" or "developmental hyperbilirubinemia". However, in about 2% of jaundiced newborns, the hyperbilirubinemia is non-physiologic – it is pathologic. In these pathologic cases, the bilirubin concentrations rise to potentially dangerous levels. Some studies report 85% of newborn re-admissions to hospital during the first week of life are because of jaundice.

Pathologic Jaundice
Pathologic jaundice is present in the first 24 hours of age. If TSB levels are greater than the 75th percentile (ie. in the high-intermediate risk zone or higher) at less than 72 hours of age, then the infant is at particularly high risk for other adverse events because the rate of bilirubin rise has been so rapid. If the bilirubin continues to rise at the same rate, then the bilirubin levels will exceed the 95th percentile within the first 7 days of age.

Pathologic jaundice (hyperbilirubinemia) may be related to:

- hemolytic disease: ABO, Rh or minor blood group incompatibilities.
- non-hemolytic disease: extravascular sources, eg. cephalohematoma
- G6PD deficiency – may be the cause of kernicterus in up to 35% of cases - always suspect in cases of severe hyperbilirubinemia or poor response to phototherapy
- decreased bilirubin conjugation – genetic disorders (Crigler-Najjar, Gilbert Syndrome), hypothyroidism
- impaired bilirubin excretion – biliary obstruction (biliary atresia), infection, metabolic disorders, chromosomal abnormalities (Turner’s), drugs (ASA, sulfa, erythromycin)

The clinical challenge is to identify when neonatal jaundice has become non-physiologic and to implement RISK REDUCTION STRATEGIES in a timely manner to prevent the occurrence of severe hyperbilirubinemia.
Physiologic Jaundice

Neonatal hyperbilirubinemia is an almost universal finding during the first week of life. Most newborns experience a transient elevation of their serum bilirubin and this is termed ‘physiologic jaundice’. The mechanisms responsible for the slightly elevated TSB levels in these infants are reflected in a combination of the effects of bilirubin production, conjugation, and enterohepatic circulation. The factors that affect these processes account for the hyperbilirubinemia in virtually all newborns. Some infants have a slower rise in their TSB (Total Serum Bilirubin) levels and may demonstrate severe hyperbilirubinemia after 72 hours of age (usually post-discharge).

Breastfeeding and Jaundice

The jaundice associated with breastfeeding in the first two to four days of life is sometimes called “breastfeeding jaundice”. Breastfeeding that is not going well, has been identified as one of the most consistent risk factors for the development of severe hyperbilirubinemia, especially in late preterm newborns (Watchko, 2006). Breastfeeding jaundice is not associated with increased bilirubin production. Rather, inadequate breastmilk intake, in addition to contributing to varying degrees of dehydration and weight loss, acts as a stimulus to increase the enterohepatic circulation of bilirubin. Earlier studies have shown that the enterohepatic circulation of bilirubin accounts for up to 50% of the hepatic bilirubin load in newborns. When the hepatic immaturity of the newborn is considered, particularly in the late preterm newborn, any further increase in the hepatic bilirubin load will likely result in more marked hyperbilirubinemia (Watchko, 2006).
SIGNS AND SYMPTOMS OF HYPERBILIRUBINEMIA REQUIRING MEDICAL INVESTIGATION

- jaundice in first 24 hours of age

- excessive level of, or rapid increase in, TSB after 24 hours of age
  - TSB level crosses into next highest risk zone on bilirubin nomogram

- TSB levels not responding to phototherapy (ie. TSB level not decreasing, or TSB level increasing)

- excessive weight loss
  - greater than 7% in first 48 hours
  - greater than 10% after 48 hours

- pallor

- vomiting

- lethargy

- poor feeding, particularly exclusive breastfeeding not going well

- hepatosplenomegaly

- apnea

- temperature instability

- tachypnea
HOUR-SPECIFIC BILIRUBIN NOMOGRAMS

It is recommended that bilirubin levels in the healthy, late preterm and term infant (35 or more weeks’ gestation) be interpreted using hour-specific bilirubin nomograms. Based on the infant’s age in hours, nomograms can be used to plot an infant’s Total Serum Bilirubin (TSB) level to determine the need to initiate phototherapy treatment in conjunction with specific risk factors for severe hyperbilirubinemia; or to plot an infant’s TSB level prior to discharge to screen for the risk of developing severe hyperbilirubinemia.

Notes on Late Preterm vs. Term infants with regard to hyperbilirubinemia (as per CPS position statement):

When considering hyperbilirubinemia in the newborn infant:

**Late Preterm** is defined as: 35 – 37 6/7 weeks gestation*

**Term** is defined as: 38 0/7 weeks gestation and older*

This is an important factor to consider. Infants of 35 to 36 weeks gestation are about 13 times more likely than those at 40 weeks gestation to be readmitted for severe jaundice. These “late preterm” infants receive care in well-baby nurseries, but unlike their term peers, they are much more likely to nurse ineffectively, receive fewer calories, and have greater weight loss. In addition, the immaturity of the liver’s conjugating system in the late preterm infant makes it much more difficult for these infants to clear bilirubin effectively. Thus, it is much more likely, and not surprising that these late preterm infants become more jaundiced.
Included in this learning package are three different hour-specific bilirubin nomograms for infants 35 or more weeks’ gestation

⇒ Bilirubin Nomogram for Initiation of Phototherapy
  - guidelines for initiation of phototherapy HAVE NOT changed

⇒ Total Serum Bilirubin Screening Assessment Nomogram
  - guidelines for screening assessment

⇒ Bilirubin Nomogram for Exchange Transfusion
  - guidelines for exchange transfusion HAVE NOT changed

* the gestational ages given for ‘late preterm’ and ‘term’ are as per CPS position statement for the management of hyperbilirubinemia
Hyperbilirubinemia in the Newborn Infant
35 or More Weeks of Gestation
Guidelines for initiation of phototherapy for hyperbilirubinemia.

Guidelines for the Initiation of Phototherapy:
Infants at Lower Risk:  greater than or equal to 38 weeks and no risk factors
Infants at Medium Risk:  greater than or equal to 38 weeks with risk factors or 35 - 37 6/7 weeks and no risk factors
Infants at Higher Risk:  35 - 37 6/7 weeks with risk factors

Risk Factors for Bilirubin Toxicity for Initiation of Phototherapy:
⇒ ABO or Rh incompatibility: hemolysis due to maternal isoimmunization. (Some other causes of hemolysis to consider if there is a positive family hx of: G6PD deficiency, pyruvate kinase deficiency, congenital spherocytosis)
⇒ sepsis, temperature instability, significant lethargy
⇒ need for resuscitation at birth/asphyxia (baby required significant resuscitation and admission to L2N or NICU at MUMC or to NICU at SJH)
⇒ evidence of metabolic or respiratory acidosis as evidenced by cord gas pH < 7.2
⇒ low serum albumin less than 30g/L (if measured)

⇒ Jaundice occurring before 24 hours of age is considered “pathologic” and requires investigation and consideration for Pediatric consult.


PHOTOTHERAPY

Old Standard of Practice
‘Single’, ‘double’ and ‘triple’ phototherapy may no longer be ordered by the physicians and midwives.

**New Standard of Practice**

New standards for phototherapy require all babies to receive *intensive phototherapy*.

*Intensive phototherapy* is defined as ‘the use of high levels of irradiance, usually 30 $\mu$W/cm$^2$/nm or higher, delivered to as much of the infant’s skin surface area as possible.

How will effective, intensive phototherapy be delivered?:

On MUMC Ward 4C:

⇒ babies who require phototherapy will be placed in an isolette to receive phototherapy via the Biliblanket Plus (delivers 57 $\mu$W/cm$^2$/nm) and 1 set of Microlights (delivers 12 – 15 $\mu$W/cm$^2$/nm).

On St. Joe’s Ward 3OBS:

⇒ babies who require phototherapy will be placed in an isolette to receive phototherapy via two sets of Microlights (deliver 12 - 15 $\mu$W/cm$^2$/nm each).

It is recommended that babies whose TSBs do not decrease within 4-6 hours once intensive phototherapy has been initiated receive a Pediatric consult.
Always consider bilirubin level by the infant’s age in hours

Adapted from American Academy of Pediatrics, Clinical Practice Guideline: Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics 2004;114:297-316
Plot the TSB result on this nomogram, then refer to TSB Screening Response Table for action to be taken (see next page).

It is recommended that either a TSB or TcB* (Transcutaneous Bilirubin) concentration be measured in all infants between 24 h and 72 h of life. If the infant does not require immediate treatment, the results should be plotted on the predictive (screening) nomogram to determine the risk of progression to severe hyperbilirubinemia. If the infant has not been measured earlier because of clinical jaundice, a TSB measurement should be obtained at the same time as the Newborn Screening test.

* At the present time, neither McMaster nor St. Joseph’s has a reliable Transcutaneous Bilirubin meter which accurately and consistently measures serum bilirubin levels.

Canadian Paediatric Society. Guidelines for detection, management and prevention of hyperbilirubinemia in term and late preterm newborn infants (35 or more weeks’ gestation). Fetus and Newborn Committee, Canadian Pediatric Society (CPS), Pediatrics and Child Health 2007; 12(5): 1B-12B.
# RESPONSE TO RESULTS OF TOTAL SERUM BILIRUBIN SCREENING

## 35 – 37 6/7 Weeks Gestation

<table>
<thead>
<tr>
<th>Bilirubin Risk Zone @ time of screening</th>
<th>35 – 37 6/7 weeks gestation with a NEGATIVE Coombs</th>
<th>35 – 37 6/7 weeks gestation with a POSITIVE Coombs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk Zone</td>
<td>Routine care</td>
<td>Routine care</td>
</tr>
<tr>
<td></td>
<td>No Coombs test required</td>
<td>No Coombs test required</td>
</tr>
<tr>
<td>Low-Intermediate Risk Zone</td>
<td>Routine care</td>
<td>Further testing or treatment required</td>
</tr>
<tr>
<td>High-Intermediate Risk Zone</td>
<td>Follow-up assessment including TSB at 24 to 48 h</td>
<td>Further testing or treatment required</td>
</tr>
<tr>
<td>High Risk Zone</td>
<td>Further testing or treatment required</td>
<td>Phototherapy required</td>
</tr>
</tbody>
</table>

TSB results in all shaded zones require Coombs test to be done if mother is Blood Group O*

## 38 Weeks Gestation

<table>
<thead>
<tr>
<th>Bilirubin Risk Zone @ time of screening</th>
<th>Greater than or equal to 38 weeks gestation with a NEGATIVE Coombs</th>
<th>Greater than or equal to 38 weeks gestation with a POSITIVE Coombs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk Zone</td>
<td>Routine care</td>
<td>Routine care</td>
</tr>
<tr>
<td></td>
<td>No Coombs test required</td>
<td>No Coombs test required</td>
</tr>
<tr>
<td>Low-Intermediate Risk Zone</td>
<td>Routine care</td>
<td>Routine care</td>
</tr>
<tr>
<td></td>
<td>No Coombs test required</td>
<td>No Coombs test required</td>
</tr>
<tr>
<td>High-Intermediate Risk Zone</td>
<td>Routine care - care provider consider a follow-up TSB if there is clinical concern</td>
<td>Follow-up assessment including TSB at 24 to 48 h</td>
</tr>
<tr>
<td>High Risk Zone</td>
<td>Further testing or treatment required</td>
<td>Further testing or treatment required</td>
</tr>
</tbody>
</table>

TSB results in all shaded zones require Coombs test to be done if mother is Blood Group O*

*Although it is highly unlikely, it is reasonable to perform a Coombs test in infants of mothers who are not Blood Group O and whose TSB results are in the High-Intermediate Risk Zone or the High Risk Zone
**Routine Care** - Follow-up appointment within 48 hours after discharge with MD or MW if infant is greater than 48 hours of age on discharge, or

- Follow-up appointment within 24 hours after discharge with MD or MW if infant is less than 48 hours of age on discharge

If the baby is in the LRZ or LIZ risk zone and there is no clinical concern, then the TSB result does not need to be reported to the MD/MW and the baby may be discharged as per **Routine Care** outlined above.

**Follow-up assessment including TSB at 24 to 48 h:**

- Follow-up assessment: babies require appointment with MD, MW or BANA within 24 - 48 hours of discharge, AND
- Follow-up TSB at 24 to 48 h:
  - In region: all babies requiring pre-ordered bloodwork should have appointment booked in BANA
  - Out of region: all babies requiring pre-ordered bloodwork may have an appointment booked in BANA or an outpatient clinic in their community.

**Further testing or treatment** – a repeat TSB should be done or intensive phototherapy should be initiated as per MD / MW order

**BANA** = Breastfeeding and Newborn Assessment Clinic
When a Coombs test needs to be done as part of the newborn hyperbilirubinemia assessment, please follow the algorithm below based upon the mother’s blood group:

**MOTHER O -ve**

- Babies of all Rh negative mothers will automatically have their blood group done at time of birth by Transfusion Medicine Lab to determine if mother needs another dose of Rh immune globulin.
  
  - Baby O –ve or O +ve
    - Coombs Test **IS NOT** required
  
  - Baby A* or B*
    - Coombs Test **IS** required

**MOTHER O +ve**

- When the Transfusion Medicine Lab receives an order to do a Coombs test, the Lab will do the baby's blood group first.
  
  - Baby O –ve or O +ve
    - Coombs Test **IS NOT** required
  
  - Baby A* or B*
    - Coombs Test **IS** required

**MOTHER A* or B**

- Coombs Test **IS NOT** required.

**NOTE:**

If any antibodies are detected prenatally, then a Coombs’ test must always be done regardless of mother’s and baby’s blood types.

*A = A +ve and A –ve  B = B+ve and B -ve*
UNIVERSAL SCREENING FOR TOTAL SERUM BILIRUBIN

The institution of a program of universal screening compliments, but does not replace, careful ongoing assessment of newborn infants beginning from the first hours of life and continuing through the first weeks. All infants should be clinically assessed for jaundice repeatedly within the first 24 h, and again, at a minimum, 24 h to 48 h later whether in hospital or after discharge. Systems to ensure follow-up within the recommended intervals after hospital discharge must be in place so that an infant who develops severe hyperbilirubinemia can be identified and treated promptly by an individual with the training to recognize neonatal hyperbilirubinemia, obtain measurement of TSB or TcB without delay and refer the infant to a treatment facility if required. This individual may be from any medical or nursing discipline. (CPS, June 2007).

1) Universal screening applies to all babies 35 or more weeks gestation in all nursery and neonatal units at both St. Joseph’s and McMaster hospitals.

2) If the TSB had not been measured earlier because of clinical jaundice, a TSB measurement should be obtained at the time of the Newborn Screening test to avoid an increase in the number of painful procedures for the infant (when the Newborn Screening test is done after 24 hours of age).

3) If a baby is being discharged at less than 24 hours of age, a TSB measurement would be inadequate (if done before 24 hours of age) to predict the risk of progression to severe hyperbilirubinemia. The CPS guidelines recommend that all babies have a TSB test between 24 – 72 hours of age. If the baby is discharged before 24 h of age, the TSB blood test should be discussed with the baby’s ongoing health care provider at his/her first visit post-discharge.

4) Staff must refer to both the Phototherapy Nomogram and the Screening Assessment Nomogram each time they view a TSB result. Staff must check each TSB result:
   - to determine if the baby is above or below the phototherapy treatment line
   - to determine which risk zone the baby’s TSB result falls into for screening (and possible Coombs test) and discharge follow-up

   If the infant does not require immediate treatment (intensive phototherapy), the TSB result should be plotted on the Screening Assessment Nomogram form to determine the risk of progression to severe hyperbilirubinemia (ie. which risk zone the baby is in).

Canadian Paediatric Society. Guidelines for detection, management and prevention of hyperbilirubinemia in term and late preterm newborn infants (35 or more weeks’ gestation). Fetus and Newborn Committee, Canadian Pediatric Society (CPS), Pediatrics and Child Health 2007; 12(5): 1B-12B.
This nomogram is for use by Pediatricians and Neonatologists but may be used as a reference guide by Family Physicians and Midwives.

**Guidelines for Exchange Transfusion in Infants 35 or More Weeks’ of Gestation**

**Bilirubin Nomogram for Exchange Transfusion**

Infants at Higher Risk

Infants at Medium Risk

Infants at Lower Risk

Age in hours

Birth 12 24 48 72 96 120 144

Bilirubin umol/L

100 150 200 250 300 350 400 450
**Guidelines:**
The dashed lines for the first 24 hours indicate uncertainty due to wide range of clinical circumstances and a range of responses to phototherapy.

Infants at Low Risk: > 38 weeks with no risk factors
Infants at Medium Risk: > 38 weeks with risk factors or 35-37 6/7 weeks with no risk factors
Infants at Higher Risk: 35-37 6/7 weeks with risk factors

**Risk Factors:**
- hemolysis due to maternal isoimmunization, G6PD deficiency, pyruvate kinase deficiency, congenital spherocytosis or other causes of hemolysis
- sepsis, temperature instability, significant lethargy
- need for resuscitation at birth/asphyxia
- evidence of metabolic or respiratory acidosis
- low serum albumin<30g/L

⇒ These exchange levels represent a consensus but are based on limited clinical evidence.
⇒ Exchange transfusion is recommended if the total serum bilirubin rises to these levels despite intensive phototherapy for 6 hours. Repeat serum bilirubin every 2 to 3 hours during intensive phototherapy.
⇒ Immediate exchange transfusion is recommended if the total serum bilirubin is 85 μmol/L above these lines or if the infant shows signs of acute bilirubin encephalopathy (hypertonia, arching, retrocolis, opisthotonus, fever, high pitched cry).
⇒ Consider exchange transfusion if the cord bilirubin is >85 μmol/L and the Hb<120g/L.
⇒ Measure serum bilirubin and calculate the bilirubin/albumin ratio (B/A ratio). The B/A ratios can be used together with but not in lieu of the serum bilirubin level as an additional factor in determining the need for exchange transfusion.

**IgG treatment for babies with immune hemolytic jaundice approaching exchange:** Infants with a positive DAT who have predicted severe disease based on antenatal investigation or an elevated risk of progressing to exchange transfusion based on postnatal progression of TSB concentrations should receive IVIG at a dose of 1 g/kg. (CPS, 2007)
KEY RECOMMENDATIONS FOR PREVENTING AND MANAGING HYPERBILIRUBINEMIA

1. Promote and support successful breastfeeding.

2. Establish nursery protocols for the jaundiced newborn and permit nurses to obtain TSB levels without a physician’s order. St. Joseph’s Healthcare and McMaster will implement a universal TSB screening program.

3. Measure the TSB or TcB* (Transcutaneous Bilimeter) concentrations of infants jaundiced in the first 24 h after birth

   *At the present time, neither McMaster nor St. Joseph’s has a reliable Transcutaneous Bilirubin meter which accurately and consistently measures serum bilirubin levels.

4. Recognize that visual diagnosis of jaundice is unreliable, particularly in darkly pigmented infants.

5. Interpret all TSB (Total Serum Bilirubin) levels according to the infant’s age in hours, not days.

6. Do not treat a near-term (35 to 38 wk) infant as a term infant; a near-term infant is at much higher risk of hyperbilirubinemia.

7. Perform a pre-discharge systematic assessment on all infants for the risk of severe hyperbilirubinemia.

8. Provide parents with information about newborn jaundice.

9. Provide follow-up based on the time of discharge and the risk assessment.

10. When indicated, treat the newborn with phototherapy or exchange transfusion.
The Hospital for Sick Children
Exchange Transfusion for Infants
<2500g and/or <35 weeks gestation

1. Use total bilirubin. Do not subtract direct or conjugated bilirubin.
2. Use gestational age rather than birthweight if gestational age is accurate.
3. In the presence of risk factors use one line lower (gestation below) until <1000g.
4. Exchange level for infants <1000g with risk factors:
   12hrs:180µmol/L; ≥24hrs:200µmol/L
6. Infants who present with total serum bilirubin (TSB) above threshold should have exchange performed if TSB is not expected to be below the threshold after 6 hours of intensive phototherapy.
7. Immediate exchange transfusion is recommended if infant shows signs of acute bilirubin encephalopathy (hypertonia, arching, retrorollis, opisthotonos, fever, high pitched cry) and usually if TSB is >85µmol/L above threshold at presentation.
8. Exchange if TSB continues to rise >17µmol/L/hour with intensive phototherapy.

References:
The Hospital for Sick Children
Phototherapy Guidelines for Infants
<35 weeks and/or <2500g

1. Use total serum bilirubin. Do not subtract direct or conjugated bilirubin.
2. Use gestational age rather than birthweight if gestational age is accurate.
3. Start phototherapy when total serum bilirubin (TSB) is < line according to gestation or weight.
4. In the presence of risk factors use one line lower (use gestation below) until <1000g.
5. Risk Factors: Isoimmune hemolytic disease, G6PD deficiency, asphyxia, sepsis, acidosis, hypoalbuminemia
6. Discontinuing phototherapy: discontinue phototherapy when the bilirubin level falls below the level at which it was initiated.

References:
PEDIATRIC FORMULARY
# ABBREVIATION (ABB.) GUIDELINES

Hamilton Health Sciences Corporation - *June 2005*

<table>
<thead>
<tr>
<th>OLD ABB. DO NOT USE</th>
<th>NEW ABB. TO BE USED</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>Unit</td>
</tr>
<tr>
<td>S. C.</td>
<td>Subcutaneous or subcut</td>
</tr>
<tr>
<td>Cc</td>
<td>ml or mL</td>
</tr>
<tr>
<td>Mg</td>
<td>microgram or mcg</td>
</tr>
<tr>
<td>MS</td>
<td>Morphine or morphine sulphate</td>
</tr>
<tr>
<td>MgSO₄</td>
<td>Magnesium Sulphate</td>
</tr>
<tr>
<td>10.0 mg</td>
<td>10 mg <em>(delete “trailing” zero)</em></td>
</tr>
<tr>
<td>.1 mg</td>
<td>0.1 mg <em>(add “leading zero)</em></td>
</tr>
<tr>
<td>q.d/o.d</td>
<td>Write <em>daily</em> out in full</td>
</tr>
<tr>
<td>&gt;</td>
<td>Write out <em>greater than</em> in full</td>
</tr>
<tr>
<td>&lt;</td>
<td>Write out <em>less than</em> in full</td>
</tr>
<tr>
<td>@</td>
<td>Write out <em>at</em> in full</td>
</tr>
<tr>
<td>O.S, O.D., O.U</td>
<td>Write out <em>left eye, right eye</em> or <em>both eyes</em> in full</td>
</tr>
<tr>
<td>A.S., A.D., A.U.</td>
<td>Write out <em>left ear, right ear</em> or <em>both ears</em> in full</td>
</tr>
</tbody>
</table>

**Legend:**

GP  Gram Positive  
GPC Gram Positive Cocci  
GN  Gram Negative  
GNB Gram Negative Bacilli  
MAX Maximum  
MIN Minimum  
NF Non-Formulary At HHS  

Adjust dosing interval for patients with renal impairment.
Safer Order Writing

In both critical care and pediatrics there is a high potential for medication errors and due to both the nature of the patients and the medications involved the consequences of any errors may catastrophic.

Some rules intended to reduce the potential for medication errors:

- Write orders clearly and concisely.
- Use generic drug names only.
- Be careful with mg/kg/DAY vs mg/kg/DOSE.
- Include the intended dose per kilogram on each order.
- Write the patients weight on each order sheet.
- Never place a decimal and a zero after a whole number (4.0 mg should be 4 mg) and always place a zero in front of a decimal point (.2mg should be 0.2 mg). The decimal point has been missed and tenfold overdoses have been given.
- Never abbreviate the word unit. The letter U has been misinterpreted as a 0, resulting in a 10 fold overdose.
- Always order medications as mg, not mL as different concentrations may exist of a given medication. There are a few exceptions such as co-trimoxazole (Septra®).
- QD is not an appropriate abbreviation for once daily, it has been misinterpreted as QID. It is best to write out “once daily” or “q24h.”
- Do not abbreviate drug names (levo, 6MP, MSO4, MgSO4, HCTZ).
- Do not abbreviate microgram to μg, use mcg, or even safer, write out microgram or use milligrams if possible (0.25 mg instead of 250 micrograms).
**ANTIBACTERIALS**

**CELL WALL SYNTHESIS INHIBITORS (BACTERICIDAL)**

### β-LACTAMS

#### PENICILLINS

<table>
<thead>
<tr>
<th>Drug</th>
<th>Spectrum</th>
<th>Antibiotic Activity</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzyl penicillin</td>
<td>Narrow spectrum; NOT Penicillinase resistant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Penicillin G (IV or IM) Penicillin V (PO) | Moderate to Severe Infections:  
**IV:** 100 000 - 400 000 Units/kg/day ÷ q4-6h (MAX: 20 million Units/day)  
**Meningitis:** IV: 400 000 Units/kg/day ÷ q4h (MAX: 20 million Units/day) |                                                                       |
| Isoxazoyl penicillin  | Narrow spectrum; Penicillinase resistant |                             |                                                                       |
| Cloxacillin (IV or PO) | Primarily used in Staphylococcal infections:  
**IV:** 100-200 mg/kg/day ÷ q6h (MAX: 8 g/day)  
**PO:** 25-50 mg/kg/day ÷ q6h (MAX: 500 mg/dose)  
Higher oral doses are poorly tolerated, usually use Cephalexin (1<sup>st</sup> Gen<sup>n</sup> Cephlasporin) |                                                                       |
| Aminopenicillin       | Broad spectrum; Penicillinase sensitive |                             |                                                                       |
| Amoxicillin (IV)      | Meningitis: IV: 200 mg/kg/day ÷ q6h (MAX: 2 g/dose)  
Note: doses of 400 mg/kg/day have been used for Meningitis  
Other infections: IV: 100-200 mg/kg/day ÷ q6h (MAX: 2 g/dose) |                                                                       |
| Amoxicillin (PO)      | Standard dose: PO: 40-50 mg/kg/day ÷ q8h  
High dose: PO: 80-90 mg/kg/day ÷ q8h (MAX: 1 g/dose) (resistant organisms, AOM)  
Severe infections and Suspected Penicillin Resistant S. pneumoniae:  
PO: doses up to 100 mg/kg/day (MAX: 1 g/dose) have been tolerated |                                                                       |
| Clavulanic Acid       | Enhances spectrum; Penicillinase inhibitor |                             |                                                                       |
| Amoxicillin + Clavulanic Acid (Clavulin) (PO) | Active against GP, GN and anaerobic organisms:  
PO: 25-40 mg/kg/day of amoxicillin component ÷ q8h (MAX: 500 mg/dose) |                                                                       |
### ANTIBACTERIALS (CONTINUED)

#### PENICILLINS (CONTINUED)

<table>
<thead>
<tr>
<th>Ureidopenicillin: broad spectrum; Penicillinase sensitive</th>
<th>Tazobactam: Enhances spectrum; β-lactamase inhibitor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Piperacillin</strong> (IV)</td>
<td>Active against GP (including S. aureus), Pseudomonas aeruginosa, GN and anaerobes (eg. Bacteroides fragilis):</td>
</tr>
<tr>
<td><strong>Piperacillin + Tazobactam</strong> (IV)</td>
<td>IV: 200-300 mg/kg/day ÷ q6h (MAX: 16 g/day)</td>
</tr>
<tr>
<td></td>
<td>(MAX: 16 g/day dose is 4.5 g [4 g Piperacillin + 0.5 g Tazobactam] q8h)</td>
</tr>
<tr>
<td></td>
<td>Order tazobactam (as x mg (or g) of piperacillin component) IV q8h</td>
</tr>
</tbody>
</table>

#### CEPHALOSPORINS

<table>
<thead>
<tr>
<th><strong>1st Generation</strong></th>
<th>GPC (except MRSA and Enterococci)</th>
<th>GNB (mainly E. coli, Klebsiella, Proteus)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cefazolin</strong> (Ancef) (IV or IM)</td>
<td>IV: 75-150 mg/kg/day ÷ q8h (MAX: 6 g/day)</td>
<td></td>
</tr>
<tr>
<td><strong>Cephalexin</strong> (Keflex) (PO)</td>
<td>PO: 25-50 mg/kg/day ÷ qid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe infections: can give 100 mg/kg/day (MAX: 4 g/day)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>2nd Generation</strong></th>
<th>Less GP more GN than 1st Generation (H. influenzae, E. coli, Klebsiella, Proteus)</th>
<th>Anaerobic activity, thus used in intra-abdominal and pelvic infections</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cefuroxime</strong> (Kefurox) (IV or IM)</td>
<td>Epiglottitis or Facial cellulitis: IV: 150 mg/kg/day ÷ q8h (MAX: 1.5 g/dose)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other infections: IV: 75-150 mg/kg/day ÷ q8h (MAX: 750 mg/dose)</td>
<td></td>
</tr>
<tr>
<td><strong>Cefuroxime Axetil</strong> (Ceftin) (PO)</td>
<td>PO: 20-30 mg/kg/day ÷ bid (MAX: 1 g/day), NF</td>
<td></td>
</tr>
<tr>
<td><strong>Cefprozil</strong> (Cefzil) (PO)</td>
<td>PO: 30 mg/kg/day ÷ q12h (MAX: 1 g/day).</td>
<td></td>
</tr>
<tr>
<td><strong>Cefotetan</strong> (Cefotan)</td>
<td>Anaerobic organisms: IV: 60 mg/kg/day ÷ q12h (MAX: 6 g/day)</td>
<td></td>
</tr>
<tr>
<td><strong>Cefoxitin</strong> (IV or IM)</td>
<td>Anaerobic organisms: IV: 80-160 mg/kg/day ÷ q8h (MAX: 8 g/day)</td>
<td></td>
</tr>
<tr>
<td><strong>Cefaclor</strong> (Ceclor) (PO)</td>
<td>PO: 20-40 mg/kg/day ÷ q8h (MAX: 1.5 g/day)</td>
<td></td>
</tr>
</tbody>
</table>
### ANTIBACTERIALS (CONTINUED)

#### CEPHALOSPORINS

<table>
<thead>
<tr>
<th>Generations</th>
<th>Activity and Coverage</th>
<th>Dosing Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3rd Generation</strong></td>
<td>Broad spectrum activity against enteric GN, less GP coverage than 1st Generation</td>
<td>Crosses Blood-Brain-Barrier unlike 1st and 2nd Generations</td>
</tr>
<tr>
<td><strong>Cefotaxime</strong> (IV or IM)</td>
<td>Meningitis: IV: 200 mg/kg/day ÷ q6h (MAX: 8 g/day)</td>
<td>Other infections (Not active against Pseudomonas aeruginosa): IV: 100-200 mg/kg/day ÷ q8h (MAX: 6 g/day)</td>
</tr>
<tr>
<td><strong>Ceftazidime</strong> (IV or IM)</td>
<td>Active against Pseudomonas aeruginosa: IV: 75-150 mg/kg/day ÷ q8h (MAX: 6 g/day)</td>
<td></td>
</tr>
<tr>
<td><strong>Ceftriaxone</strong> (IV or IM)</td>
<td>Meningitis: IV/IM: 80 mg/kg/dose q12 hours x 3 doses then q24h (MAX: 2 g/dose)</td>
<td>IV/IM: 50-75 mg/kg q24h (MAX: 2 g/day)</td>
</tr>
<tr>
<td></td>
<td>Restricted at HHS to patients without IV access, otherwise use cefotaxime</td>
<td></td>
</tr>
<tr>
<td><strong>Cefixime</strong> (Suprax) (PO)</td>
<td>Uncomplicated Cervical or Urethral Gonorrhea: PO: 400 mg once (minimum weight 45 kg)</td>
<td>Other infections (Not active against Pseudomonas or S. aureus): PO: 8 mg/kg/day ÷ q12-24h (MAX: 400 mg/day)</td>
</tr>
<tr>
<td></td>
<td>Restricted at HHS to treatment of STDs</td>
<td></td>
</tr>
</tbody>
</table>

#### GLYCOPEPTIDES

<table>
<thead>
<tr>
<th>Activity and Coverage</th>
<th>Dosing Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only active against GP; True major penicillin allergic patients</td>
<td></td>
</tr>
<tr>
<td><strong>Vancomycin</strong> (IV or PO)</td>
<td>Meningitis: IV: 60 mg/kg/day ÷ q6h (MAX: 4 g/day)</td>
</tr>
<tr>
<td></td>
<td>Pseudomembranous Colitis Refractory to Metronidazole: PO: 50 mg/kg/day ÷ q6h (MAX: 500 mg/day)</td>
</tr>
<tr>
<td></td>
<td>Monitor trough levels in patients with septic shock, concurrent nephrotoxins, fluctuating renal function or extended treatment courses</td>
</tr>
</tbody>
</table>
## ANTIBACTERIALS (CONTINUED)

### Protein Synthesis Inhibitors

#### VIA 50S Ribosome (Bacteriostatic)

### MACROLIDES

- **Atypical**: Mycoplasma, Legionella, Chlamydia, Treponema, H. pylori
- **GPC**: streptococcal infections in patients allergic to penicillin
- **UTI, Community Acquire Pneumonia** as outpatient

<table>
<thead>
<tr>
<th>Erythromycin</th>
<th>IV: 25-50 mg/kg/day ÷ q6h (MAX: 4 g/day)</th>
<th>PO: 20-40 mg/kg/day ÷ q6h (MAX: 2 g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GI adverse effects common, even with IV use. Thrombophlebitis common.</td>
<td>Rx Interactions: ↑ levels of midazolam, carbamazepine, theophylline, cyclosporine, phenytoin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clarithromycin</th>
<th>Rx Interactions: theophylline, carbamazepine, cisapride, digoxin, cyclosporine, tacrolimus.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Azithromycin</th>
<th>PO/IV: 10 mg/kg (MAX: 500 mg) once, then 5 mg/kg (MAX: 250 mg) q24h for 4 days/doses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For serious infections may give 10 mg/kg q24h for 4 days or doses</td>
</tr>
<tr>
<td></td>
<td>Chlamydial infection (non-gonococcal urethritis or cervicitis):</td>
</tr>
<tr>
<td></td>
<td>PO: 1 g once (MIN weight 45 kg)</td>
</tr>
</tbody>
</table>

### LINCOSAMIDES

- **GP and Anaerobic infections** (B. fragilis, C. perfringens)

<table>
<thead>
<tr>
<th>Clindamycin</th>
<th>IV: 30-40 mg/kg/day ÷ q8h (MAX: 900 mg/dose)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO: 10-20 mg/kg/day ÷ q6-8h (MAX: 450 mg/dose)</td>
</tr>
<tr>
<td></td>
<td>May potentate muscle weakness with neuromuscular blockers. Oral suspension is very poorly tolerated, avoid if possible, use 150 mg capsules or an alternative antibiotic</td>
</tr>
</tbody>
</table>
### ANTIBACTERIALS (CONTINUED)

#### VIA 30S Ribosome (Bacteriostatic)

<table>
<thead>
<tr>
<th>AMINOGLYCOSIDES</th>
<th>GN Aerobes + Mycobacteria; Tobramycin for Pseudomonas Requires oxygen for uptake therefore ineffective against anaerobes</th>
</tr>
</thead>
</table>
| Gentamicin       | IV: 5-6 mg/kg/dose **q24h** or 2.5 mg/kg/dose **q8h**  
Once daily dosing should be used for all patients > 1 month of age, except in the treatment of endocarditis and in patients with extensive burns. Ototoxicity and nephrotoxicity may occur, consider monitoring trough levels (target <2 mg/L) in patients at risk for nephrotoxicity; septic shock, concurrent nephrotoxins, fluctuating renal function or extended treatment courses. May potentiate muscle weakness with neuromuscular blockers |

#### Folic Acid Metabolism Inhibitors (Bacteriostatic)

| TRIMETHOPRIM-SULFAMETHOXAZOLE (TMP-SMX) (Septra, Co-trimoxazole) | SMX alone: Norcardia  
Combo: Pneumocystis carinii, Toxoplasma, Shigella, Salmonella |
|---------------------------------------------------------------|---------------------------------------------------------------|

**Bacterial infections (UTI):**  
PO/IV: 8 mg/kg/day (of Trimethoprim component) ÷ q12h  
**Pneumocystis carinii pneumonia (PCP):**  
PO/IV: 20 mg/kg/day (of Trimethoprim component) ÷ q6h  
If PCP is severe (i.e. hypoxia), consider adding Methylprednisolone 1 mg/kg q24h  
Order in mL of suspension or injection or number of tablets:

<table>
<thead>
<tr>
<th></th>
<th>Trimethoprim</th>
<th>Sulfamethoxazole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspension</td>
<td>8 mg/ml</td>
<td>40 mg/ml</td>
</tr>
<tr>
<td>Injection</td>
<td>16 mg/ml</td>
<td>80 mg/ml</td>
</tr>
<tr>
<td>Tablet</td>
<td>80 mg</td>
<td>400 mg</td>
</tr>
<tr>
<td>DS Tablet</td>
<td>160 mg</td>
<td>800 mg</td>
</tr>
</tbody>
</table>

Excellent oral absorption, use IV only if PO contraindicated. Maintain good fluid intake and urine output. Monitor CBC and LFTs. Do not use in patients with G-6-PD deficiency.
### DNA Gyrase Inhibitors (Bactericidal)

**QUINOLONES**

<table>
<thead>
<tr>
<th>Ciprofloxacin (IV or PO)</th>
<th>Enteric GNB; Pseudomonas aeruginosa. Ciprofloxacin has been used in pediatrics but the association between ciprofloxacin and the development of arthropathy in humans is still controversial</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV/PO: 20-30 mg/kg/day ÷ q12h (MAX: 400 mg/dose IV or 750 mg/dose PO)</td>
<td>Excellent oral absorption, use IV only if PO contraindicated. Feeds, formula, calcium, magnesium, iron, antacids and sulcralfate reduce absorption, hold feeds for 1 hour before and 2 hours after dose.</td>
</tr>
</tbody>
</table>

**METRONIDAZOLE (IV or PO)**

| Anerobic infections: IV/PO: 20-30 mg/kg/day ÷ q12h (MAX: 1 g/day) |
| A. aerogenes (For Colitis): (Enteral administration preferred but IV can be used) IV/PO: 30 mg/kg/day ÷ q6-8h (MAX: 1.5 g/day) |
| C. difficile (For Colitis): (Enteral administration preferred but IV can be used) IV/PO: 30 mg/kg/day ÷ q6-8h (MAX: 1.5 g/day) |
| Excellent oral absorption, use IV only if PO contraindicated or not tolerated |

### DNA Complex Damaging Agents (Bactericidal)

**ANTIFUNGALS**

<table>
<thead>
<tr>
<th>Fluconazole (IV or PO)</th>
<th>Oropharyngeal candidiasis: IV/PO: 3 mg/kg q24h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esophageal candidiasis: IV/PO: 6 mg/kg q24h (MAX: 400 mg/day)</td>
<td></td>
</tr>
<tr>
<td>Candidemia: IV/PO: 12 mg/kg once (MAX: 800 mg) Then 6 mg/kg/day (MAX: 400 mg/day, ↑ doses used)</td>
<td></td>
</tr>
<tr>
<td>Excellent oral absorption, use IV only if PO contraindicated. May increase serum levels of cyclosporine, midazolam, cisapride, phenytoin. Aspergillus species and Candida krusei are intrinsically resistant, Candida glabrata may respond to higher doses.</td>
<td></td>
</tr>
</tbody>
</table>

| Nystatin (Topical) | Oral candidiasis: PO: infants: 100 000 Units swish and swallow q6h children: 250 000 Units swish and swallow q6h adolescents: 500 000 Units swish and swallow q6h |
PEDIATRIC FORMULARY

Acetaminophen
Analgesic and antipyretic.

PO/PR: 40-60 mg/kg/day ÷ q4-6h (maximum 60 mg/kg or 4 g/day). A single dose greater than 150 mg/kg is generally considered to be toxic, but toxicity has been reported at lower doses (90-120 mg/kg/day). Rectal absorption may be erratic, consider increasing dose by approximately 20%.

1 microgram/mL = 6.62 micromol/mL.

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Single Dose (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 - 3.9</td>
<td>40</td>
</tr>
<tr>
<td>4.0 - 5.4</td>
<td>60</td>
</tr>
<tr>
<td>5.5 - 7.9</td>
<td>80</td>
</tr>
<tr>
<td>8.0 - 10.9</td>
<td>120</td>
</tr>
<tr>
<td>11.0 - 15.9</td>
<td>160</td>
</tr>
<tr>
<td>16.0 - 21.9</td>
<td>240</td>
</tr>
<tr>
<td>22.0 - 26.9</td>
<td>320</td>
</tr>
<tr>
<td>27.0 - 31.9</td>
<td>400</td>
</tr>
<tr>
<td>32.0 - 43.9</td>
<td>480</td>
</tr>
<tr>
<td>44 – over</td>
<td>650</td>
</tr>
</tbody>
</table>

Acetylsalicylic Acid

Antiplatelet:
PO: 5 mg/kg/dose q24h.
Minimum 20 mg, usual maximum 80 or 325 mg.

Kawasaki disease:
PO: 80-100 mg/kg/day ÷ q6h, reduce dose to 3-5 mg/kg q24h once fever resolves.
Supplied as 80 mg chewable tablets and 325 and 650 mg tablets.

Captopril
Angiotensin converting enzyme inhibitor.
PO: 0.1-0.3 mg/kg/dose q8h initially (usual maximum 6 mg/kg/day or 200 mg/day).
Monitor blood pressure closely after first dose, may cause profound hypotension.
Carbamazepine
Anticonvulsant.
   PO: 10-20 mg/kg/day initially, usual maintenance dose is 20-30 mg/kg/day. Divide daily dose q8-12h. Serum trough concentration target is 17-51 micromol/L (4-12 microgram/mL).

Charcoal
Adsorbent used in toxic ingestions.
   PO: 1-2 g/kg once.
   PO: Multiple dose therapy 0.5 g/kg q4-6h.
Give via NG if necessary, consider antiemetics.

Chloral Hydrate
Sedative and hypnotic.
   Procedural Sedation:
      PO/PR: 80 mg/kg, may repeat half dose if no effect in 30 minutes (maximum 2 g/dose).
   Sedation:
      PO/PR: 25-50 mg/kg/dose (maximum 500 mg q6h or 1 g hs).
Avoid in liver dysfunction. Tolerance develops and withdrawal may occur after long-term use. For PR use dilute syrup with water.

Codeine
Opiate analgesic used to treat mild-moderate pain.
   PO/IM/SC: 0.5-1 mg/kg q4h prn (maximum 60 mg/dose).
Not for IV use due to significant histamine release and possible cardiovascular side effects. Not commonly used in ICU setting.
Dexamethasone
Corticosteroid.

**Croup:**
IV/IM/PO: 0.6 mg/kg once.

**Meningitis:**
IV: 0.15 mg/kg/dose q6h for 4 days.
   Begin with first antibiotic dose.

**Prevention of post-extubation stridor:**
IV: 0.25-0.5 mg/kg/dose (maximum 10 mg/dose) q6h x 6 doses.
   Begin 24 hours pre-extubation if possible.

**Increased ICP due to space occupying lesion:**
IV/PO: 0.2-0.4 mg/kg initially followed by
   0.3 mg/kg/day ÷ q6h.

Discontinuation of therapy >14 days requires gradual tapering. Consider supplemental steroids at times of stress if patient has received long-term or frequent bursts of steroid therapy. Prolonged weakness may occur when corticosteroids are used concurrently with non-depolarizing neuromuscular blocking agents.

Dextrose

**Treatment of hypoglycemia:**
IV: 0.5-1 g/kg/dose:
   1-2 mL/kg of 50% dextrose
   5-10 mL/kg of 10% dextrose

1 mmol of dextrose (0.2 g of dextrose) provides 2.8 kJ (0.67 kcal).

Diazepam
Benzodiazepine sedative, anxiolytic and amnestic.

**Status epilepticus:**
IV: 0.25 mg/kg/dose (maximum 5 mg, 10 mg for older children).
PR: 0.5 mg/kg/dose (maximum 20 mg/dose).

**ICU sedation:**
IV: 0.1-0.3 mg/kg q1h prn.

Fast onset and short duration of action with single doses, duration of action prolonged with continued use. Not first line drug for ICU sedation due to short duration of action and the potential for accumulation. Withdrawal may occur if discontinued abruptly after prolonged use. Not recommended for
continuous infusion due to poor solubility. Can give parenteral preparation rectally, diluted with water.

**Dimenhydrinate (Gravol)**
Antihistamine used to treat nausea and vomiting.

    IV/IM/PO: 1 mg/kg/dose q4-6h (maximum 50 mg/dose).

**Diphenhydramine (Benadryl)**
Antihistamine used primarily to treat urticaria.

    IV/IM/PO: 0.5-1 mg/kg/dose q6h (maximum 50 mg/dose).

**Domperidone**
Prokinetic agent.

    PO: 1.2-2.4 mg/kg/day ÷ q6h (maximum 80 mg/day).

**Enoxaparin**
Anticoagulant, low-molecular weight heparin.

*Treatment:*

    SC: <2 months of age: 1.5 mg/kg/dose q12h.
    >2 months of age: 1 mg/kg/dose q12h.

*Prophylaxis:*

    SC: <2 months of age: 0.75 mg/kg/dose q12h.
    >2 months of age: 0.5 mg/kg/dose q12h.

Monitor platelets and hemoglobin. Avoid in severe renal dysfunction. Anti-factor Xa level drawn 4 hours post SC injection should be 0.5-1 unit/mL for treatment and 0.2-0.4 unit/mL for prophylaxis.

**Epinephrine (Racemic)**

*Post-extubation stridor/croup:*

Use 1:1000 epinephrine(racemic 2.25% not available)

<table>
<thead>
<tr>
<th>Patient Age</th>
<th>Patient Weight</th>
<th>Volume (mL) epinephrine 1:1000</th>
<th>Volume of preservative-free saline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 year</td>
<td>Plus less than 5 kg</td>
<td>0.5 mL/kg</td>
<td>Add saline to give total of 2 to 3 mL total volume for nebulization</td>
</tr>
<tr>
<td>Less than 1 year</td>
<td>Greater than or 5 kg</td>
<td>2.5 mL</td>
<td>0.5 mL saline to total volume of 3 mL</td>
</tr>
<tr>
<td>1 year or older</td>
<td>Greater than 5 kg</td>
<td>5 mL</td>
<td>Do not dilute with saline</td>
</tr>
</tbody>
</table>
Ferrous Sulfate: See iron.

Fluticasone (Flovent)
Inhaled corticosteroid.
   INH: 125-500 microgram q12h.
Higher doses may be required if administered through a ventilator due to loss of drug in the circuit.

Furosemide
Loop diuretic.
   PO: 1-2 mg/kg/dose, adjust dose/frequency prn, usually q6-24h.
   IV: 0.5-2 mg/kg/dose, adjust dose/frequency prn, usually q6-24h
   or
   begin at 0.1 mg/kg/hour and titrate to clinical effect
   (maximum 0.5 mg/kg/h).

Hydrochlorothiazide
Thiazide diuretic.
   PO: 2-4 mg/kg/day ÷ q12h.

Hydrocortisone
Corticosteroid.
   Acute asthma:
   IV: 5 mg/kg/dose q6h for 24-48 hours then reassess.
   Anaphylaxis:
   IV: 5-10 mg/kg/dose.
   Anti-inflammatory:
   IV: 2.5-10 mg/kg/day ÷ q6-8h.
   Acute adrenal crisis:
   IV: 1-2 mg/kg then:
      Infants: 25-150 mg/day ÷ q6h.
      Older children: 150-300 mg/day ÷ q6h.
Discontinuation of therapy >14 days requires gradual tapering. Consider supplemental steroids at times of stress if patient has received long-term or frequent bursts of steroid therapy. Prolonged weakness may occur when corticosteroids are used concurrently with non-depolarizing neuromuscular blocking agents.
Ibuprofen
Analgesic and anti-inflammatory (NSAID).
   PO: 5-10 mg/kg/dose q6-8h (maximum 2,400 mg/day).
Adverse effects include renal dysfunction, GI irritation and ulceration.

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Insulin
Recombinant human insulin.
   Diabetic ketoacidosis:
      IV: 0.05-0.1 units/kg/h initially. (add 25 units of regular insulin to 250 ml/NS)
      For IV administration MUST use regular insulin.
   Hyperkalemia:
      IV: 0.1 units/kg AND dextrose 0.5 g/kg.
   Diabetes mellitus:
      SC: 0.3-0.5 unit/kg/day in divided doses (as a combination of short and long acting insulins). Adjust as required based on blood glucose measurements, usually 0.5-1 unit/kg/day.
With continuous infusions measure blood glucose q1h initially, adjust dose as required based on blood glucose measurements.

Ipratropium (Atrovent)
Inhaled anticholinergic bronchodilator.
   Severe asthma:
      NEB: 125-250 microgram (0.5-1 mL) q4-6h.
      INH: 2-4 puffs q4-6h.
Higher doses may be required if administered through a ventilator due to loss of drug in the circuit.
Iron
Treatment of iron deficiency anemia:
PO: 4-6 mg/kg/day (of elemental iron) ÷ q8-24h.

Prevention of iron deficiency anemia:
PO: 2-3 mg/kg/day (of elemental iron) q24h.

Give with food if GI upset occurs.

Kayexelate® (Sodium Polystrene Sulfonate)
Cation exchange resin.
Treatment of hyperkalemia:
PO/PR: 1 g/kg/dose may be repeated prn
(usual maximum 30-60 g/dose).

Give in water or juice, do not mix with fruit juices with high potassium content such as orange juice.

Ketorolac (Toradol)
Analgesic and anti-inflammatory (NSAID).
IV/IM: 1-2 mg/kg/day (maximum 120 mg/day) ÷ q6h.
PO: 10 mg q6h (minimum weight 45 kg).

For oral use give ibuprofen or naproxen for younger children. There is limited experience with multiple dose ketorolac in pediatric patients. Adverse effects include renal dysfunction, GI irritation and ulceration.

Lactulose
Osmotic laxative.
PO: infants: 2.5-5 mL q8-24h.
children: 5-10 mL q8-24h.
adolescents: 15-30 mL q8-24h.
**Lorazepam**

Benzodiazepine sedative, anxiolytic and amnestic.

- **Status epilepticus:**
  - **IV:** 0.1 mg/kg/dose, (usual maximum 4 mg/dose).
  - **PR:** 0.2 mg/kg/dose.

- **ICU Sedation:**
  - **IV/PO:** 0.05-0.1 mg/kg/dose q1h prn +/- scheduled doses
    (may increase to 0.2 mg/kg/dose).

Intermediate duration of action and no active metabolites. Withdrawal may occur if discontinued abruptly after prolonged use. Not recommended for continuous infusion due to poor solubility. May give parenteral preparation rectally, diluted with water.

**Methylprednisolone**

Corticosteroid.

- **Acute asthma:**
  - **IV:** 1-2 mg/kg/day q6h (max 60mg/day) until improvement seen
    (usually 24-48 hours) then q24h or switch or oral prednisone.

- **Anti-inflammatory:**
  - **IV:** 1-2 mg/kg q24h.

- **High dose/pulse therapy:**
  - **IV:** 10-30 mg/kg q24h x 1-3 doses.

Discontinuation of therapy >14 days requires gradual tapering. Consider supplemental steroids at times of stress if patient has received long-term or frequent bursts of steroid therapy. Prolonged weakness may occur when corticosteroids are used concurrently with non-depolarizing neuromuscular blocking agents.

**Metoclopramide**

Antiemetic, gastrointestinal prokinetic agent.

- **IV/PO:** 0.4-0.8 mg/kg/day ÷ q6h (usual maximum 40 mg/day).

Extrapyramidal reactions occur more commonly in children and may be treated with diphenhydramine.
Morphine
Narcotic analgesic.
  Sedation/analgesia:
  IV:  0.05-0.1 mg/kg/dose q2-4h and increase as required
       or
       0.1 mg/kg then 10-40 (usual maximum 100) microgram/kg/h.
       For breakthrough, use 1-1.5 times the hourly dose +/- increase the
       infusion.
Reduced doses may be required if used in combination with benzodiazepines.
Use with caution in non-ventilated patients due to potential for respiratory
depression. There is no upper dose limit if increased gradually. To prevent
withdrawal, avoid abrupt cessation following high doses or long duration of
therapy (> 5 days). Common adverse effects are pruritus, nausea and
constipation, which may be overlooked in PICU patients.

Naproxen
Analgesic and anti-inflammatory (NSAID).
  PO:  10-20 mg/kg/day ÷ q8-12h (maximum 1 g/day).
Adverse effects include renal dysfunction, GI irritation and ulceration.

Nebulized Hypertonic Saline

| Mix 4mL of 3% Hypertonic Saline with |
| 1.5mL of 1:1000 Epinephrine Solution* |
| Administer by Nebulizer Every 8 Hours |
| Until Discharge from Hospital |

Omeprazole
Inhibitor of gastric acid secretion (proton pump inhibitor).
  PO:  0.7-1.4 mg/kg/day ÷q12-24h (maximum 40 mg/day).
Do not give crushed tablets without sodium bicarbonate solution. An oral
solution is available for doses other than 10 and 20 mg but is very unpalatable
and should be given via feeding tube.
Ondansetron
Antiemetic.
IV/PO: 0.15 mg/kg/dose q8h (maximum 8 mg/dose).

Pantoprazole
Inhibitor of gastric acid secretion (proton pump inhibitor).
There is limited experience with pantoprazole in pediatric patients.
PO/IV: Adult dose: 40 mg q24h (maximum q12h),
1 mg/kg q24h has been used in pediatric patients.
Major gastrointestinal hemorrhage:
IV: Adult dose: 80 mg loading dose then 8 mg/h.
There is more data with the use of oral omeprazole in pediatric patients.
Intravenous and oral pantoprazole provide equivalent acid suppression. Do not crush tablets.

Phenobarbital
Barbiturate anticonvulsant.
Status epilepticus:
IV: 15-20 mg/kg over 20-30 minutes.
Maintenance:
IV/PO: 3-5 mg/kg/day ÷ q12-24h.
Usual serum level for seizure control: 65-172 micromol/L (15-40 mg/L).

Phenytoin
Anticonvulsant, antiarrhythmic.
Status epilepticus:
IV: 15-20 mg/kg over 20 minutes.
Maintenance:
IV/PO: 5 mg/kg/day (range 3-10 mg/kg/day) ÷ q8-12h.
Anti-arrhythmic:
IV: 1.25 mg/kg q5min until arrhythmia suppressed
(magnitude of 15 mg/kg total dose),
or
15 mg/kg over 20 min.
May require higher doses for patients with head injuries. Must be diluted in saline only and requires in-line filter (0.22 micron). Hold feeds before and after enteral administration as continuous feeds and formula may decrease bioavailability of oral products. Significantly increased free fraction in patients
with hypoalbuminemia may result in underestimation of effective drug concentration and difficulty in interpretation of drug levels and toxicity may occur at “therapeutic” serum levels. Therapeutic level: 40-80 micromol/L (10-20 microgram/mL).

**Piperacillin**

Broad spectrum penicillin.

IV: 200-300 mg/kg/day ÷ q6h (maximum 16 g/day).

Adjust dose interval in severe renal impairment. Active against Pseudomonas aeruginosa.

**Piperacillin/Tazobactam**

Broad spectrum penicillin with beta-lactamase inhibitor.

IV: 200-300 mg/kg/day (of piperacillin component) ÷ q6-8h.

Max dose is 4.5 g (4 g piperacillin + 0.5 g tazobactam) q8h

Order in mg or g of piperacillin, for example, give piperacillin/tazobactam (as x mg of piperacillin component) IV q8h. Adjust dosage interval for patients with severe renal impairment. Active against gram positive, (including S. aureus), gram negative and anaerobic organisms.

**Potassium Chloride**

Electrolyte.

Treatment of hypokalemia:

PO: 1-2 mEq/kg/day ÷ q6-12h.

IV: 0.25-1 mEq/kg/dose.

**Risk of arrhythmias and cardiac arrest with rapid IV administration.**

Dose recommendations assume normal renal function. Maximum rate of administration in PICU is 0.5 mEq/kg/h (maximum 20 mEq/h). Use 0.1 mEq/mL for peripheral use, 0.2 mEq/mL for central lines. For maintenance fluids the usual maximum concentration for a peripheral IV is 40 mEq/L.

**Prednisone or Prednisolone**

Corticosteroid.

Acute asthma:

PO: 1-2 mg/kg q24h.

Anti-inflammatory or immunosuppressive:

PO: 0.5-2 mg/kg 24h, dose may be tapered as tolerated.
1 mg Prednisone = 1 mg Prednisolone. Discontinuation of therapy >14 days requires gradual tapering. Consider supplemental steroids at times of stress if patient has received long-term or frequent bursts of steroid therapy. Prolonged weakness may occur when corticosteroids are used concurrently with non-depolarizing neuromuscular blocking agents.

**Racemic Epinephrine**

See epinephrine.

**Ranitidine**

H₂ receptor antagonist.

Reduction of gastric acid secretion:

- **IV:** 2-6 mg/kg/day ÷ q6-12h (usual maximum 50 mg q6-8h).
- **PO:** 4-10 mg/kg/day ÷ q8-12h (usual maximum 300 mg/day).

IV dose is approximately 50% of oral dose. Modify dosage interval for patients with renal impairment. May add daily dose to TPN.

**Salbutamol (Ventolin)**

Bronchodilator, β₂ agonist.

**Acute asthma:**

- **MDI:** start at 2-4 puffs q20-60min prn. Higher doses may be required if administered through a ventilator due to loss of drug in the circuit.
- **NEB:** 0.01-0.03 mL/kg/dose (5 mg/mL solution, maximum 1 mL) in 2-3 mL NS q½-4h, may give continuously if required.
- **IV:** 1 microgram/kg/min, increase q15min prn to maximum of 10 microgram/kg/min.

**Maintenance therapy:**

- **MDI:** 1-2 puffs q4h prn.

**Acute treatment of hyperkalemia:**

- **IV:** 4 microgram/kg over 20 min.

Titrate dose to effect and/or adverse effects (tachycardia, tremor and hypokalemia). For most patients metered dose inhalers with a spacer device are the preferred method of drug delivery. Wet nebulization is less efficient and more costly. Monitor serum potassium, especially with IV. Cardiac monitoring required for IV use.
Senna
Stimulant laxative.
   PO: infants: 1 or 2.5 mL (1.7 or 4.25 mg) q24h.
       children: 2.5 or 5 mL (4.25 or 8.5 mg) q24h.
       adolescents: 5 or 10 mL (8.5 or 17 mg) q24h.
Some patients, particularly those receiving opiates may require higher doses and/or more frequent administration. Also supplied as 8.6 mg tablets.

Spironolactone
Potassium sparing diuretic.
   PO: 1-3 mg/kg/day ÷ q8-24h.

Valproic Acid and Derivatives
Anticonvulsant.
   PO: 15-20 mg/kg/day increased to a maximum of 30-60 mg/kg/day ÷ q6-12h.
   IV: Divide total daily maintenance q6h.
Desired therapeutic range: 350-690 micromol/L (50-100 microgram/mL). Dosing is equivalent for valproic acid, divalproex and sodium valproate.

Vitamin K
Reversal of prolonged clotting times or warfarin induced anticoagulation.
   IV/PO: 0.5-10 mg/dose.
Use lower doses if there is no significant bleeding and patient will require warfarin in the future. May repeat in 6-8 hours. Injection may be given by mouth, undiluted or in juice or water.
PEDIATRIC EMERGENCY MEDICINE
PALS: PULSELESS ARREST ALGORITHM

1. PULSELESS ARREST
   - BLS Algorithm: Continue CPR
   - Give oxygen when available
   - Attach monitor/defibrillator when available

2. Check rhythm
   - Shockable rhythm?

3. VF/VT
   - Give 1 shock
     - Manual: 2 J/kg
     - AED: >1 year of age
       Use pediatric system if available for 1 to 8 years of age
       Resume CPR immediately
   - Resume CPR immediately
     - Give 5 cycles of CPR

4. Check rhythm
   - Shockable rhythm?

5. Give 5 cycles of CPR
   - No

6. Continue CPR while defibrillator is charging
   - Give 1 shock
     - Manual: 4 J/kg
     - AED: >1 year of age
       Resume CPR immediately
     - Give epinephrine
       - IV/IO: 0.01 mg/kg
       - (1:10 000: 0.1 mL/kg)
       - Endotracheal tube: 0.1 mg/kg
       - (1:1000: 0.1 mL/kg)
       Repeat every 3 to 5 minutes

7. Check rhythm
   - Shockable rhythm?

8. Give 5 cycles of CPR
   - No

9. Asystole/PEA
   - Resume CPR immediately
     - Give epinephrine
       - IV/IO: 0.01 mg/kg
       - (1:10 000: 0.1 mL/kg)
       - Endotracheal tube: 0.1 mg/kg
       - (1:1000: 0.1 mL/kg)
       Repeat every 3 to 5 minutes

10. Check rhythm
    - Shockable rhythm?

11. Give 5 cycles of CPR
    - No

12. Check rhythm
    - Shockable rhythm?

13. Go to Box 4

During CPR
   - Push hard and fast (100/min)
   - Ensure full chest recoil
   - Minimize interruptions in chest compressions
   - One cycle of CPR: 15 compressions
     then 2 breaths; 5 cycles =1 to 2 min
   - Avoid hyperventilation
   - Secure airway and confirm placement.
   - After an advanced airway is placed, rescuers no longer deliver “cycles” of CPR. Give continuous chest compressions without pauses for breaths. Give 8 to 10 breaths/minute. Check rhythm every 2 minutes.
   - Rotate compressors every 2 minutes with rhythm checks
   - Search for and treat possible contributing factors:
     - Hypovolemia
     - Hypoxia
     - Hyperkalemia
     - Hyperglycemia
     - Hypothermia
     - Tachyarrythmias
     - Hypocalcemia
   - Hypertension
   - Trauma
PALS: BRADYCARDIA ALGORITHM

1. BRADYCARDIA With a Pulse Causing cardiorespiratory compromise

2. Support ABCs as needed
   - Give oxygen
   - Attach monitor/defibrillator

3. Bradycardia still causing cardiorespiratory compromise?

4. Perform CPR if despite oxygenation and ventilation HR <60/min with poor perfusion

5A. Support ABCs; give oxygen if needed
   - Observe
   - Consider expert consultation

5. Persistent symptomatic bradycardia?

6. Give epinephrine
   - IV/IO: 0.01 mg/kg (1:10,000: 0.1 mL/kg)
   - Endotracheal tube: 0.1 mg/kg (1:1000: 0.1 mL/kg)
   - Repeat every 3 to 5 minutes

   - If increased vagal tone or primary AV block:
     - Give atropine, first dose: 0.02 mg/kg, may repeat. (Minimum dose: 0.1 mg; maximum total dose for child: 1 mg.)

   - Consider cardiac pacing

7. If pulseless arrest develops, go to Pulseless Arrest Algorithm

Reminders
- During CPR, push hard and fast (100/min)
- Ensure full chest recoil
- Minimize interruptions in chest compressions
- Support ABCs
- Secure airway if needed; confirm placement
- Search for and treat possible contributing factors:
  - Hypovolemia
  - Hypoxia or ventilation problems
  - Hyperkalemia
  - Hypoglycemia
  - Hypothermia
  - Toxins
  - Tamponade, cardiac
  - Tension pneumothorax
  - Thrombosis (coronary or pulmonary)
  - Trauma (hypovolemia, increased ICP)
PALS: TACHYCARDIA ALGORITHM WITH PULSES AND POOR PERFUSION

1. TACHYCARDIA With Pulses and Poor Perfusion
   - Assess and support ABCs as needed
   - Give oxygen
   - Attach monitor/defibrillator

2. Evaluate QRS duration
   - Narrow QRS (<0.08 sec)
   - Evaluate QRS duration
   - Wide QRS (>0.08 sec)

3. Evaluate rhythm with 12-lead ECG or monitor

4. Probable Sinus Tachycardia
   - Compatible history consistent with known cause
   - P waves present/normal
   - Variable R-R; constant P-R
   - Infants: rate usually <120 bpm
   - Children: rate usually <180 bpm

5. Probable Supraventricular Tachycardia
   - Compatible history (vague, nonspecific)
   - P waves absent/abnormal
   - HR not variable
   - History of abrupt rate changes
   - Infants: rate usually >120 bpm
   - Children: rate usually >180 bpm

6. Search for and treat cause

7. Consider vagal maneuvers (No delays)

8. If IV access readily available:
   - Give adenosine 0.1 mg/kg (maximum first dose 6 mg) by rapid bolus
   - May double first dose and give once (maximum second dose 12 mg)
   - Synchronized cardioversion: 0.5 to 1 J/kg; if not effective, increase to 2 J/kg
   - Sedate if possible but don’t delay cardioversion

9. Possible Ventricular Tachycardia

10. Synchronized cardioversion: 0.5 to 1 J/kg; if not effective, increase to 2 J/kg
    - Sedate if possible but don’t delay cardioversion
    - May attempt adrenaline if it does not delay electrical cardioversion

11. Expert consultation advised
    - Amiodarone 5 mg/kg IV over 20 to 60 minutes
    - Procaaine 15 mg/kg IV over 30 to 60 minutes
    - Do not routinely administer amiodarone and procaaine together

During Evaluation
- Secure, verify airway and vascular access when possible
- Consider expert consultation
- Prepare for cardioversion

Treat possible contributing factors:
- Hypovolemia
- Hypoxia
- Hypoglycemia
- Hypothermia
- Toxins
- Tamponade, cardiac
- Tension pneumothorax
- Thrombosis (coronary or pulmonary)
- Trauma (hypovolemia)
# PALS Medications for Cardiac Arrest and Symptomatic Arrhythmias

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose</th>
<th>Supplied</th>
<th>Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adenosine</strong></td>
<td>IV/IO: 0.1 mg/kg</td>
<td>3 mg/mL: 0.03 mL/kg</td>
<td>Rapid bolus followed by rapid flush</td>
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<tr>
<td></td>
<td>Max 6 mg</td>
<td>Max 2 mL</td>
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<td></td>
<td>Repeat dose: 0.2 mg/kg</td>
<td>Max 12 mg</td>
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<td></td>
<td>Max 4 mL</td>
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<tr>
<td>*<em>Amiodarone</em></td>
<td>IV/IO: 5 mg/kg</td>
<td>50 mg/mL: 0.1 mL/kg</td>
<td>Rapid bolus for VF/VT, over 20-60 minutes for perfusing tachycardias</td>
</tr>
<tr>
<td></td>
<td>(Max 300 mg)</td>
<td>Max 6 mL</td>
<td></td>
</tr>
<tr>
<td><strong>Atropine</strong></td>
<td>IV/IO: 0.02 mg/kg</td>
<td>0.1 mg/mL: 0.2 mL/kg</td>
<td>Bolus</td>
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<tr>
<td></td>
<td>Min 0.1 mg</td>
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<tr>
<td></td>
<td>Max 0.5 mg for child</td>
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<td></td>
<td>Max 1 mg for adolescent</td>
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<td></td>
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<tr>
<td></td>
<td>ET: use 2-10 times IV dose</td>
<td></td>
<td>Dilute with NS to 3-5 mL</td>
</tr>
<tr>
<td><strong>Calcium Chloride</strong></td>
<td>IV/IO: 20 mg/kg</td>
<td>10% solution: 0.2 mL/kg</td>
<td>Give slow push, central line preferred</td>
</tr>
<tr>
<td><strong>Dextrose</strong></td>
<td>IV/IO: 0.5-1 g/kg</td>
<td>D₁₀W: 5-10 mL/kg</td>
<td>Avoid hyperglycemia</td>
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<tr>
<td></td>
<td></td>
<td>D₅₀W: 1-2 mL/kg</td>
<td></td>
</tr>
<tr>
<td><strong>Epinephrine</strong></td>
<td>IV/IO: 0.01 mg/kg</td>
<td>1:10 000: 0.1 mL/kg</td>
<td>Bolus</td>
</tr>
<tr>
<td></td>
<td>ET: 0.1 mg/kg</td>
<td>1:1 000: 0.1 mL/kg</td>
<td>Dilute with NS to 3-5 mL</td>
</tr>
</tbody>
</table>
### PALS Medications for Cardiac Arrest and Symptomatic Arrhythmias

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<thead>
<tr>
<th>Medication</th>
<th>Dose</th>
<th>Supplied</th>
<th>Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lidocaine</strong></td>
<td><strong>IV/IO: 1 mg/kg</strong></td>
<td>20 mg/mL: 0.05 mL/kg</td>
<td>Bolus</td>
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<tr>
<td></td>
<td>ET: use 2-10 times the IV dose</td>
<td></td>
<td>Dilute with NS to 3-5 mL</td>
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<tr>
<td></td>
<td>IV/IO Infusion: 20-50 microgram/kg/min</td>
<td>Add 100 mg to total of 100 mL</td>
<td>Run at 1.2 - 3 mL/kg/h</td>
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<tr>
<td><strong>Magnesium Sulfate</strong></td>
<td><strong>IV/IO: 25-50 mg/kg</strong> (max 2 g)</td>
<td>0.5 g/mL: 0.05-0.1 mL/kg (max 4 mL)</td>
<td>Rapid infusion for torsades or severe hypomagnesemia</td>
</tr>
<tr>
<td><strong>Naloxone</strong></td>
<td><strong>IV/IO/IM: 0.1 mg/kg</strong> (max 2 mg)</td>
<td>0.4 mg/mL: 0.25 mL/kg (max 5 mL)</td>
<td>Bolus</td>
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<tr>
<td></td>
<td>ET: use 2-10 times the IV dose</td>
<td></td>
<td>Dilute with NS to 3-5 mL</td>
</tr>
<tr>
<td><strong>Procainamide</strong></td>
<td><strong>IV/IO: 15 mg/kg</strong></td>
<td>100 mg/mL: 0.15 mL/kg (max 10 mL)</td>
<td>Give over 30-60 minutes</td>
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<td>*do not routinely use in Combination with other drugs that prolong QT interval</td>
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<tr>
<td><strong>Sodium Bicarbonate</strong></td>
<td><strong>IV/IO: 1 mEq/kg</strong></td>
<td>4.2%: 2 mL/kg 8.4%: 1 mL/kg</td>
<td>Give slowly and if ventilation is adequate. Use 4.2% in neonates</td>
</tr>
<tr>
<td><strong>Cardioversion</strong></td>
<td>0.5 J/kg, double dose if arrhythmia continues</td>
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<tr>
<td><strong>Defibrillation</strong></td>
<td>2 J/kg initially then 4 J/kg for each subsequent defibrillation attempt.</td>
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<tr>
<td><strong>ETT size</strong></td>
<td>(age in years /4 ) + 4</td>
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</table>
### Status Epilepticus in Infants & Children

**Therapeutic Guidelines**

<table>
<thead>
<tr>
<th>TIME</th>
<th>ACTION</th>
</tr>
</thead>
</table>
| 0 – 5 mins    | Assess Cardio-Respiratory function. Open airway, provide \( O_2 \)  
REMAIN WITH PATIENT  
Apply cardiac and oximetry monitors.  
Frequently reassess airway & oxygenation |
| 5-10 mins     | ESTABLISH IV ACCESS (use intra-osseous if unable to get IV)  
**FIRST DRUG:** each given over 1 minute  
LORAZEPAM (LZ) IV 0.1 mg/kg (1\(^{st}\) choice) OR  
DIAZEPAM (DZ) IV 0.25 mg/kg  
**IF NO IV:**  
RECTAL administration of LZ or DZ at double the dose OR  
IM MIDAZOLAM 0.25-0.5 mg/kg  
Note: Diazepam and Midazolam must be followed by loading dose of Phenytoin (see below)  
DRAW BLOOD: cap glucose (BS), gases, lytes, Ca, Mg  
± toxin screen ± Anti-Epileptic Drug (AED) levels  
START IV INFUSION 0.9 NaCl +  
Bolus of D25W 2mL/kg if immediate BS result is not available |
| 10 - 15 mins  | MONITOR VITAL SIGNS  
Reassess airway, possible need for intubation.  
Lower body temperature if > 39 \(^\circ\)C  
If available, administer PYRIDOXINE 200 mg IV before long half-life anticonvulsants are given to infants < 2 years of age  
Repeat LORAZEPAM or DIAZEPAM dose once 5 minutes after first dose |
| 15-30 mins    | **SECOND DRUG:**  
PHENYTOIN IV 20mg/kg in saline line  
(glucose will cause it to precipitate)  
Give over 20 minutes. Monitor vital signs.  
If seizure does not stop, give extra 5 mg/kg IV  
Contact tertiary referral centre/ PICU  
DO NOT TRANSFER IF STILL CONVULSING!  
**THIRD DRUG:**  
PHENOBARBITAL IV 20mg/kg over 20 minutes.  
Monitor vital signs.  
Watch for apnea, especially with benzodiazepines.  
May repeat Phenobarbital 10mg/kg twice |
### Status Epilepticus in Infants & Children

**Therapeutic Guidelines (Continued)**

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
</table>
| **30-60 minutes**           | Mandatory **Intubation** (Rapid Sequence Intubation) and Ventilation Monitor in PICU  
**Midazolam Infusion:**  |
|                             | Load 0.15mg/kg, then infuse at 1-2mcg/kg/min  
Titrate q15mins increasing by 1mcg/kg/min as needed  
until seizures controlled  
Mean range 2-4mcg/kg/min.  
Watch BP.  
**Barbituate Anaesthesia:**  |
|                             | **Thiopental** (Pentothal): Load 3-5mg/kg (1.5 mg/kg/min).  
May repeat x2. Infusion 25-400 mcg/kg/min.  
(For burst suppression may need levels of 250 mcg/L or 1000 mmol/L).  
Titrate to response.  
Watch for hypotension (common!), use inotropes PRN.  
**Pentobarbital** (Nembutal):  |
|                             | Load 3-5mg/kg over 20 minutes.  
May repeat x2.  
Infusion 1-3mg/kg/hr (to maintain EEG burst suppression levels 10-25mcg/ml).  
At 25mcg.ml there is consistent burst suppression but 60% of patients are hypotensive! Use inotropes early!  
**Note:**  |
|                             | • Attention to ABCs before treating the seizure.  
• Stop seizures ASAP.  
• Do not transfer without loading Phenytoin ± Phenobarbital  
• Always communicate with tertiary referral centre |

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DIABETIC KETOACIDOSIS EMERGENCY GUIDELINES

HISTORY (some or all of)
- Polyuria
- Polydipsia
- Weight loss
- Abdominal pain
- Tiredness
- Vomiting
- Confusion
- Difficulty breathing

CLINICAL SIGNS generally include
- Deep sighing respirations with no wheeze or rhonchi (Kussmaul breathing)
- Smell of Ketones on breath
- Lethargy / drowsiness
- Dehydration - mild to severe

PERFORM THESE TESTS:
- Urine ketones / glucose
- Capillary glucose STAT in ER
- Venous blood - glucose, gases, electrolytes, urea or creatinine
- Consider other tests as necessary

CONFIRM DKA and refer to Pediatrician:
- Ketonuria
- Glucose > 11 mmol/L
- pH < 7.3
- Serum Bicarbonate < 18 mmol/L

HYPOTENSION (< 5th percentile for age)
- < 4 years: < 70/30
- 4-10 years: < 80/40
- 10-13 years: < 85/40
- > 13 years: < 90/45

VASCULAR DECOMPENSATION (shock)
- Hypotension (see box)
- Decreased level of consciousness

RESUSCITATION
- Airway
- Normal Saline 10 mL/kg to expand vascular space (may be repeated as necessary) to correct shock
- Decrease to 5 mL/kg/hr
- Bicarbonate replacement is not recommended for routine use

CLINICALLY DEHYDRATED OR HYPERVERVENTILATING OR VOMITING
- Normal Saline 7 mL/kg over 1st hour
- Then 3.5-5 mL/kg/hr (including insulin)

NO VASCULAR DECOMPENSATION
- Normal BP
  - Not dehydrated
  - Tolerating fluids orally
  - Normal bowel sounds
- Oral hydration
- SC insulin
Continuous insulin infusion 0.1 units/kg/hr = 1 mL/kg/hr (of solution of 25 units of Regular Insulin in 250 cc NS)
- DO NOT GIVE BOLUS OF INSULIN
- Start Pediatric Diabetic Ketoacidosis Flowsheet
  If history of voiding within last hour and [K+] < 5.5 mmol/L:
  - Add 40 meq/L of KCl to IV fluid

NEUROLOGICAL DETERIORATION
Headache, irritability, decreased level of consciousness, decreased HR, seizure, hypothermia
First rapidly exclude hypoglycemia by capillary blood glucose measurement
THEN
Treat for cerebral edema

ACIDOSIS NOT IMPROVING
(in 3-4 hours)
- Check insulin delivery system and net fluid balance
- Consider sepsis
- Contact Tertiary Pediatrics Diabetes Centre

ACIDOSIS IMPROVING BUT
Blood glucose < 15 mmol/L OR
Blood glucose falls > 5 mmol/L/h:
- Change IV to D5/normal saline
- Decrease insulin to 0.04-0.05 U/kg/hr = 0.4-0.5 mL/kg/hr standard solution as above
- If Blood glucose < 10mmol/L change to D10/normal saline

TREATING CEREBRAL EDEMA
- 20% Mannitol 5mL/kg over 20 minutes
- If measured Na has declined administer 2-4 mL/kg of 3% saline over 10-20 min then resume normal saline rehydration
- Decrease insulin to 0.04-0.05 U/kg/hr = 0.4-0.5 mL/kg/hr standard solution as above
- Contact Tertiary Pediatric Diabetes Center
- Admit to ICU

Clinically Improved, tolerating oral fluids, pH > 7.3, HCO₃ > 18 mmol/L:
- Start SC insulin
- Stop IV insulin 1/2 hour after SC dose of Humalog insulin or 1 hour after SC dose of regular insulin
- Determine cause of DKA
- Contact Tertiary Pediatric Diabetes Center

OBSERVATION AND MONITORING:
- Hourly blood glucose (capillary)
- Aim for a decrease in blood glucose of 5 mmol/L/h, and pH increase of 0.03 units/h.
- Hourly documentation of fluids input/output
- Hourly, at least, assessment of neurological status
- 1 hour after start of IV - electrolytes, venous gases - then q2h or more frequently if indicated
- Follow Effective Osmolality = (2X measured Na + measured blood glucose)
- Avoid a decrease of > 2-3 mmol/L/hr in effective osmolality by increasing IV sodium concentration
- Timely consultation with pediatric endocrinologist

Adapted from 2021
Ministry of Health Guidelines
### Maintenance Fluid Requirements

#### Example

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Hourly Fluid Rate (c.c./hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>6-16 c.c./hr</td>
</tr>
<tr>
<td>20-40</td>
<td>4 c.c./hr</td>
</tr>
<tr>
<td>&gt;40</td>
<td>2 c.c./hr</td>
</tr>
</tbody>
</table>

### Fahrenheit - Celsius

<table>
<thead>
<tr>
<th>Fahrenheit</th>
<th>Celsius</th>
</tr>
</thead>
<tbody>
<tr>
<td>39.9°F</td>
<td>37.8°C</td>
</tr>
<tr>
<td>38.0°F</td>
<td>36.6°C</td>
</tr>
<tr>
<td>37.2°F</td>
<td>35.9°C</td>
</tr>
</tbody>
</table>

### Normal Pediatric Vital Signs

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Pulse</th>
<th>Respiration</th>
<th>Systolic Blood Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+ to 2</td>
<td>120-160</td>
<td>20-40</td>
<td>70-90</td>
</tr>
<tr>
<td>1 to 3</td>
<td>120-160</td>
<td>20-40</td>
<td>70-90</td>
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<tr>
<td>3 to 5</td>
<td>120-160</td>
<td>20-40</td>
<td>70-90</td>
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<tr>
<td>6 to 8</td>
<td>120-160</td>
<td>20-40</td>
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<tr>
<td>9 to 12</td>
<td>120-160</td>
<td>20-40</td>
<td>70-90</td>
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<tr>
<td>13 to 18</td>
<td>120-160</td>
<td>20-40</td>
<td>70-90</td>
</tr>
</tbody>
</table>

### Glasgow Coma Score

<table>
<thead>
<tr>
<th>Eye Opening</th>
<th>Motor Response</th>
<th>Verbal Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>None</td>
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### Blood Pressure

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