المرشد العلاجي في
تدبير الأذيات الحادة للنخاع الشوكي

ملخص :

تعتبر الأذيات الحادة للنخاع الشوكي حدثاً مغيراً للحياة , و التدبير يجب أن يكون متعدد الاختصاصات . بالتدبير الباكر يجب تقديم الدعم الحياتي المناسب للرضوض مع تجنب هبوط ضغط الدم , بطء القلب , نقص الأكسجة.

يجب إجراء استشارة جراحة عصبية في الوقت المناسب لعلاج الأذيات القابلة للتراجع و تمكين المريض من البدء الباكر بالتأهيل .

المرشدات الطبية القائمة على الأدلة وضعت خطة عمل مناسبة لتقييم و علاج أذيات النخاع الرضية .

التوصيات :

المستوى الأول : لا شيء

المستوى الثاني :

- التنبيب الباكر مع التهوية الآلية موصى به للمرضى ذوي الأذيات العالية المستوى (ر 1 - ر 5) .
- استخدام جرعة عالية من الميتيل بريدنيزولون غير موصى به .
- الوقاية الكيماوية من الخثار الوريدي بالهيبارين غير المجزأ يجب البدء بها خلال 24 سا من الإصابة .

المستوى الثالث :

- زيادة MAP(الضغط الشرياني الوسطي) باستخدام النورأدرينالين (عند الحاجة) موصى به خلال الـ 72 ساعة الأولى التالية للإصابة على الأقل و لمدة 7 أيام كحد أقصى .
- الـ MAPالمطلوب > 85 ملمز للأذيات الكليلة أو النافذة بشكل غير كامل .
- الـ MAPالمطلوب > 65 ملمز للأذيات النافذة بشكل كامل .
- تخفيض الضغط الباكر جراحياً لانضغاطات النخاع (< 72 ساعة) موصى به .

- خزع رغامى باكر (< 7 أيام) في الأذيات الرقبية عالية المستوى (ر1 - ر5) .
- يجب البدء بالتأهيل الباكر لجميع المرضى .

المقدمة :

تعتبر الأذيات الحادة للنخاع الشوكي (SCI) حدثاً مدمراً يستدعي تدخل فريق متعدد الإختصاصات .
الأهداف العامة للعناية بمريض الـ SCIتتضمن :

1. التأكد من مستوى الأذية النخاعية مع التواصل مع فريق العناية الطبية .
2. الوقاية من الأحداث الضارة كالإنتانات المشفوية (HAI) , القرحات الاضطجاعية ...
3. خلق بيئة مناسبة للمريض من إمكانيات التواصل , العناية التمريضية , الوقاية من السقوط .
4. تثقيف المريض و الأهل حول طبيعة الأذية و خطة المعالجة .
5. البدء الباكر بالتأهيل .
6. الامتناع عن القبول مرة ثانية في حال عدم الضرورة .

القبول و الإنذار :

تقديم الدعم الحياتي القلبي المتقدم ACLSعند الحاجة .
تقييمات الدعم الحياتي للرضوض

●الطريق الهوائي / التنفس :

1. الهدف : تجنب نقص الأكسجة .
2. تقييم الحاجة للتنبيب
3. التنبيب السريع بانبوب رغامي عند الحاجة
4. التركين (في حال التنبيب) : فينتانيل 50 مكغ / سا تسريب وريدي مستمر للوصول إلى قيمة سلم تهدئة التركين لريتشموند (RASS) من 0 إلى 2 .

●الدوران :

1. الهدف : تجنب هبوط الضغط و بطء القلب
2. الـ MAP> 85 ملمز في أذيات النخاع الشوكي الرضية أو النافذة بشكل غير كامل .
3. الـ MAP> 65 ملمز للأذيات النافذة بشكل كامل .
4. هبوط الضغط (انظر إلى الـ MAPالمطلوب في الأعلى)
5. الاستجابة الأولية : البدء بالسوائل الوريدية حيث يكون الحد الأقصى 2 لتر محلول ملحي .
6. هبوط الضغط المستمر : نورأدرينالين 0.05 مكغ /كغ/د للحفاظ على الـ MAPالمطلوب .

- **المحافظة على ثبات العمود الفقري للمرضى في حال الشك بأذية فقرية .**
- **تبديل اللوح بفرشة أو سطح مبطن في حال الإمكانية مع الحفاظ على ثبات العمود الفقري .**
- **إكمال القصة المرضية و الفحص السريري .**
- **إجراء تحاليل أولية : غازات دم شريانية ...**
- **إجراء صورة صدر .**
- **تخطيط قلب .**
- **اختبارات تنفسية (عند المريض غير المنبب) :** القوة الشهيقية السلبية NIF, السعة الحيوية FVC, الحجم الجاري TV
- **تدبير الألم (عند المريض غير المنبب) :** فينتانيل 25 - 50 مكغ وريدي خلال ساعة أو مورفين 2 - 5 ملغ خلال ساعة .
- **متطلبات القبول**

٨.يمكن الاستفادة من (معايير القبول في الـ SCI)

تحديد و علاج جميع الأجهزة (التنفسي , القلبي الوعائي , الجهد , الوقاية من الخثار الوريدي ,

الهضمي , الحمية , متطلبات وحدة العناية المشددة) .

وحدات القبول :

- كل مرضى أذيات النخاع الرضية يمكن قبولهم في وحدات خاصة , (N4E) NSICU] TICU (N4W) , TSD (N8W) , NSD (N8E) , S4A أو N10W/N10E فقط]
- كل مرضى أذيات النخاع الرقبي المترافق مع عجز يتم قبولهم في البداية للمراقبة التنفسية اللصيقة .
- في المرضى المصابين بأذيات نخاع سفلية (قطني , صدري) المترافق مع عجز يمكن قبولهم في أي وحدة من الوحدات المذكورة آنفاً و ذلك اعتماداً على الاستقرار السريري و الحاجة للمراقبة .

ACUTE SPINAL CORD INJURY MANAGEMENT

SUMMARY

Acute spinal cord injury is a life-altering event. Spinal cord injury management should be multidisciplinary. Early management should incorporate a full Advanced Trauma Life Support (ATLS) assessment with the intent to avoid hypotension, bradycardia, and hypoxia. Timely neurosurgical consultation is essential to treat remediable injury and enable the patient to begin early rehabilitation. This evidence-based medicine guideline presents a system-based approach to the care of patients with acute spinal cord injury.

RECOMMENDATIONS

- **Level 1**
  - **None**
- **Level 2**
  - **Early intubation and mechanical ventilation is recommended for patients with high cervical injuries (C1-C5).**
  - **Use of high-dose methylprednisolone is not recommended.**
  - **Chemical venous thromboembolism prophylaxis, with unfractionated heparin, should be initiated within 24 hours of injury.**
- **Level 3**
  - **Mean arterial pressure (MAP) augmentation with norepinephrine (if needed) is recommended for at least the first 72 hours following injury to a maximum of 7 days.**
    - **Goal MAP ≥ 85 mmHg for blunt / incomplete penetrating injury**
    - **Goal MAP ≥ 65 mmHg for complete penetrating injury**
  - **Early neurosurgical decompression of acute spinal cord compression (< 72 hours) is recommended.**
  - **Consider early tracheostomy (< 7 days) in high cervical injury (C1-C5) patients.**
  - **Rehabilitation should be offered to all patients.**

INTRODUCTION

Acute spinal cord injury (SCI) is a devastating event that requires management using a multidisciplinary team approach. Overall goals for the care of a SCI patient include:

1. Confirmation of the SCI level with communication to the entire healthcare team
2. Prevention of harm events such as hospital acquired infection (HAI), pressure ulcers, etc…
3. Creation of an environment of safety for the patient with adequate methods to communicate needs, adaptive call system for nurses, and interventions to prevent falls
4. Education of both patient and family regarding injury and plan of care
5. Facilitation of timely discharge to rehabilitation
6. Prevention of unnecessary readmission

EVIDENCE DEFINITIONS

- **Class I:** Prospective randomized controlled trial.
- **Class II:** Prospective clinical study or retrospective analysis of reliable data. Includes observational, cohort, prevalence, or case control studies.
- **Class III:** Retrospective study. Includes database or registry reviews, large series of case reports, expert opinion.
- **Technology assessment:** A technology study which does not lend itself to classification in the above-mentioned format. Devices are evaluated in terms of their accuracy, reliability, therapeutic potential, or cost effectiveness.

LEVEL OF RECOMMENDATION DEFINITIONS

- **Level 1:** Convincingly justifiable based on available scientific information alone. Usually based on Class I data or strong Class II evidence if randomized testing is inappropriate. Conversely, low quality or contradictory Class I data may be insufficient to support a Level I recommendation.
- **Level 2:** Reasonably justifiable based on available scientific evidence and strongly supported by expert opinion. Usually supported by Class II data or a preponderance of Class III evidence.
- **Level 3:** Supported by available data, but scientific evidence is lacking. Generally supported by Class III data. Useful for educational purposes and in guiding future clinical research.

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Trauma Alert / Admission

- Advanced Cardiac Life Support (ACLS) protocol if needed
- Advanced Trauma Life Support (ATLS) protocol evaluation
    - Airway/Breathing
        - Goal: avoid hypoxia
        - Assess need for intubation
            - If needed, Rapid Sequence Intubation per protocol with HiLo Evac endotracheal tube
            - Sedation (*if intubated*): Fentanyl drip 50 mcg/hr IV continuous – titrate to maintain Richmond Agitation Sedation Score (RASS) 0 to -2
    - Circulation
        - Goal: avoid hypotension and bradycardia
            - MAP goal ≥ 85 mmHg for blunt & incomplete penetrating SCI injury
            - MAP goal ≥ 65 mmHg for complete penetrating SCI injury (ASIA A)
        - Hypotension (see goal MAP above)
            - Initial response: fluid challenge with a maximum 2 L NS bolus
            - Persistent hypotension: Norepinephrine 0.05 mcg/kg/min titrated to maintain MAP goals
- Immobilize the spine of all patients with a potential spinal injury
- Remove backboard as soon as possible; transfer onto a firm, padded surface/mattress while maintaining spinal alignment
- Complete detailed history/physical
- Obtain initial labs: Trauma A, arterial blood gas (ABG)
- Baseline chest radiograph
- Baseline EKG
- Baseline respiratory mechanics *(non-intubated patient)*: negative inspiratory force (NIF), forced vital capacity (FVC), tidal volume (TV)
- Pain management (*non-intubated patient*): Fentanyl 25-50 mcg IV q1 hr prn pain OR Morphine 2-5 mg IV q1 hr prn pain
- Admission orders
    - Utilize the “Spinal Cord Injury Admission Order Set”
        - Addresses all systems (respiratory, cardiovascular, skin, venous thromboembolism prophylaxis, gastrointestinal, bowel regimen, standard ICU orders)

Admission Units

- All traumatic SCI patients are admitted to designated units [NSICU (N4E), TICU (N4W), TSD (N8W), NSD (N8E), S4A or N10W/N10E only]
- All cervical SCI patients with deficits are initially admitted to NSICU (N4E) or TICU (N4W) for close respiratory monitoring
- Lower SCI patients (thoracic/lumbar) with deficits are admitted to any of the above units depending on clinical stability and need for monitoring

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Use of High-Dose Methylprednisolone in Blunt Spinal Cord Injury		
See the Methylprednisolone in Acute Spinal Cord Injury guideline • The use of high-dose methylprednisolone is NOT recommended. • The risks associated with high-dose steroids outweigh any potential limited benefit.		
	Phase 1 - Critical Care Unit	**Phase 2 – Step-down or Med/Surg**
Neurologic Goals: • Define level of injury • Set a baseline for sensory, motor, & reflex status	• Consider use of the Rotorest bed for patients who will require prolonged spine immobilization • Document sensory, motor, and reflex status within first 24 hours to ICU and then Q 24 hrs x 3 days • Neurosurgery/Attending to communicate level of injury to patient / family • Neurosurgery – consider early stabilization (<72 hours post-injury) ○ Urgent for bilateral locked facets with incomplete SCI ○ Urgent for acute neurologic deterioration • Basic neurologic assessment by nursing per unit protocol • Repeat neuro assessments after any transfer for reduction movements	• Continue current care • Basic neuro assessment by nursing per unit protocol
	Phase 1 - Critical Care Unit	**Phase 2 – Step-down or Med/Surg**
Respiratory Goals: • Decrease/prevent atelectasis • Enhance clearance of secretions • Prevent pneumonia	Monitoring: (per ICU protocol) • Fever (temperature > 38.5°C) • Change in respiratory rate • Increased work of breathing • Increased pulse rate • Increase or change in secretions (color, quantity, consistency) • Declining respiratory mechanics • Decrease in SaO_2	Monitoring: (per ICU protocol) • Quadriplegic patients may only be transferred to TSDU (N8W) or NSDU (N8E) due to the high risk of respiratory deterioration and availability of a respiratory therapist • Same as Phase 1 • Respiratory & Speech Therapy to assess need for in-line Passy Muir Valve (PMV)
	Standard Monitoring Orders: • Respiratory: FVC, NIF, & peak flow Q shift • Vital signs per ICU protocol • Non-intubated: Incentive spirometer readings Q 1 hr	Standard Monitoring Orders: • Respiratory: FVC, NIF, & peak flow Q shift (decrease to Q 24 hrs if stable x 72 hours) • Vital signs per unit protocol • Non-intubated/trached: Incentive spirometry Q 1 hr while awake
	Ventilator Orders: • Mechanical ventilation per protocol • Consider using higher tidal volumes (10-15 ml/kg) to resolve or prevent atelectasis • Begin weaning ventilator per protocol (including SAT/SBT if patient meets criteria) • Consider diaphragmatic pacer placement to facilitate ventilator weaning for tetraplegic patients	Ventilator Orders: • Continue weaning per protocol • Consider larger TV ventilation

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	Phase 1 - Critical Care Unit	Phase 2 – Step-down or Med/Surg
Respiratory Goals: • Decrease/prevent atelectasis • Enhance clearance of secretions • Prevent pneumonia	**Standard Respiratory Care for all VENTILATED SCI patients:** • VAP protocol (oral care Q 4 hrs, HOB>30°, etc) • Chlorhexidine (Peridex®) oral rinse 15 mL swish & suction Q 12 hrs • Metaneb Q 4 hrs • Cough Assist Q 4 hrs following Metaneb if PEEP <5 cm H_20 • Consider Vest Therapy Q 4 hours if can't tolerate Metaneb • Albuterol 2.5mg/3 mL nebulized Q4hrs • Abdominal binder when OOB to chair • Assess need for respiratory suctioning frequently to avoid mucous plugs • Consider early tracheostomy (<7 days post-injury or 4 days after anterior fusion unless other neurosurgical concern)	**Standard Respiratory Care for all VENTILATED SCI patients:** • Continue current care • If minimal to no secretions, change albuterol to PRN • Discontinue chlorhexidine (Peridex®) when patient is tolerating oral diet
	Standard Respiratory Care for all NON-VENTILATED SCI Patients WITHOUT evidence of respiratory compromise/ disease: • Monitor for need for mechanical ventilation (respiratory failure, intractable atelectasis on CXR, weakening voice, etc.) • Incentive Spirometry Q 1-2 hrs • EZ-PAP Q 4 hrs • Cough Assist Device Q 4 hrs following EZ-PAP • Albuterol 2.5 mg/3 mL nebulized Q 4hrs prn increased secretions / wheezing	**Standard Respiratory Care for all NON-VENTILATED SCI Patients WITHOUT** evidence of respiratory compromise/ disease: • Continue current care • Discontinue albuterol if not needed for > 72 hrs
	NON-VENTILATED SCI Patients "aggressive protocol" **WITH** history of smoking/respiratory disease **OR** increased secretions / change in pulmonary function: • Assess need for NT suctioning • Discontinue EZ-PAP • Metaneb Q 4 hrs • Cough Assist Device Q 4 hrs following Metaneb • Albuterol 2.5mg/3mL nebulized Q 4hrs • Abdominal binder when OOB to chair	**NON-VENTILATED SCI Patients** on "aggressive protocol" • Assess need for NT suctioning • Continue current care • When improved mechanics, switch Metaneb to EZ-PAP • If minimal to no secretions, change albuterol to PRN
	Thick Secretions • Heated humidification to ventilator circuit • 3% Saline nebulized Q 8 hrs after albuterol and before cough assist • Consider bronchoscopy/BAL	Thick Secretions • Continue current therapy • Discontinue mucolytics when secretions become thin

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	Phase 1 - Critical Care Unit	Phase 2 – Step-down or Med/Surg

Cardiac
Goals:
• Restore normal hemodynamic parameters
• Avoid hypotension
• Avoid symptomatic bradycardia
	Hypotension
	• Normal saline (NS) 2L IV – only for trauma bay resuscitation
	• Maintenance of MAP ≥ 85 mmHg for at least 72 hrs in blunt SCI (to a maximum of 7 days post-injury)
	  ○ Reassess duration based on clinical response
	  ○ Do NOT use for patients with irreversible SCI
	• Norepinephrine 0.05 mcg/kg/min – titrate to goal MAP
	  ○ Blunt SCI / incomplete penetrating: MAP ≥ 85 mmHg
	  ○ Complete penetrating SCI: MAP ≥ 65 mmHg (ASIA A)
	• Persistent hypotension – check random Cortisol level
	  ○ Cortisol < 20 mcg/dL and still on norepinephrine = start Hydrocortisone 100 mg IV Q 8 hrs
	• Midodrine 5 mg PO/PT Q 8 hrs
	  ○ Initiate early for all patients with oral / enteral access requiring MAP augmentation
	  ○ Titrate to maintain goal MAP
	  ○ Maximum 15 mg PO/PT Q 6 hrs
	• Apply TED hose and ACE wraps to BLE prior to assisting OOB to chair – remove when back to bed
	• SCDs while in bed
	Bradycardia
	• Assess for presence of mucous plugs (most common cause of acute bradycardia)
	  ○ Ambu-bag with FiO_2 1.0 and suction
	• Atropine 0.5 mg IV Q 1 hr PRN heart rate < 40 and/or symptomatic
	If persistent symptoms of bradycardia, consider starting:
	• Albuterol 2 mg PO/PT Q 6 hrs (up to 4 mg Q 6 hrs)
	• Caffeine 200 mg PO/PT Q 12 hrs
	• Robinul 0.1-0.2 mg IV / 1-2 mg PO/PT Q 8-12 hrs
	NOTE: Caution in patients with thick pulmonary secretions
	• External pacing or temporary pacemaker for severe, refractory symptomatic bradycardia
		Hypotension
		• Norepinephrine must be off prior to transfer from ICU
		• Midodrine 5 mg PO/PT Q 8 hrs
		  ○ Titrate to maintain goal MAP; maximum 15 mg PO/PT Q 6 hrs
		  ○ Monitor for need / wean dose as tolerated
		• Apply TED Hose and ACE wraps to BLE prior to assisting OOB to chair – remove when back in bed
		• SCDs while in bed
		Bradycardia
		• Same as Phase I
		• If persistent symptoms of bradycardia – call Rapid Response Team (RRT).

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	Phase 1 - Critical Care Unit	Phase 2 – Step-down or Med/Surg
Gastrointestinal Goals: • Tolerate diet • Scheduled BM • Minimal diarrhea / constipation Review OH Bowel Training Flow Chart (next page)	**Monitoring Parameters:** • If NG/PEG: check residuals Q 4 hrs– Goal < 250 mL • Monitor for signs/symptoms of nausea / vomiting • Goal: 1 bowel movement daily – document on nursing flowsheet • Assess abdomen for s/s of ileus	**Monitoring Parameters:** • Same as Phase 1
	Stress Ulcer Prophylaxis: • Pepcid 20 mg IV/PT/PO Q 12 hrs	**Stress Ulcer Prophylaxis:** • Continue as long as the patient remains on the ventilator • Discontinue when the patient is off the ventilator and tolerating tube feeds at goal or regular diet x 48 hrs unless another indication (e.g. GERD) to continue therapy
	Gastric Emptying / Tube Feeding Intolerance: • If PEG/NG feeding – change to post-pyloric DHT (placed into the duodenum) • If persistent feeding intolerance, add a prokinetic agent (e.g. metoclopramide, erythromycin, etc.)	**Gastric Emptying / Tube Feeding Intolerance:** • Discontinue prokinetic agent when the patient is at goal tube feeding rate x 48 hrs
	Bowel Regimen – Prevent/Treat Constipation: • Per Tube: Senna 10 mL PT Q 12 hrs, Docusate Sodium (Colace) 100 mg PT Q 12 hrs • Oral: Senna-S 2 tabs PO Q 12 hrs • Bisacodyl 10 mg PR Daily (2000) with digital stimulation – only discontinue if excessive diarrhea *If No BM by 72 hours after admission:* • Sorbitol 30 mL PO/PT Q 12 hrs until 1st bowel movement • Milk of Magnesia 30 mL PO/PT Q day • Increase Bisacodyl (Dulcolax) suppository to Q 12 hrs • Miralax 17 g PO/PT daily	**Bowel Regimen – Prevent/Treat Constipation:** • If no diarrhea and having daily BM, continue current regimen • Note: change senna / docusate liquid to Senna-S 2 tabs PO Q 12 hrs if patient able to swallow pills • Follow Phase 1 recommendations for constipation
	Diarrhea (liquid >500 mL Q 8 hrs and/or >3 stools/day for 2 days): • Hold bowel regimen • Metamucil/Benefiber 1pkt PO/PT Q12H • Consider loperamide / lomotil for 24 hours if persistent diarrhea >500mL / 24h and other causes of diarrhea ruled out (e.g. C. difficile colitis)	**Diarrhea (liquid >500 mL Q 8 hrs and/or >3 stools/day for 2 days):** • Same as Phase 1 • Resume Docusate Sodium (Colace) & Bisacodyl (Dulcolax) 1st – then add Senna if constipation an issue

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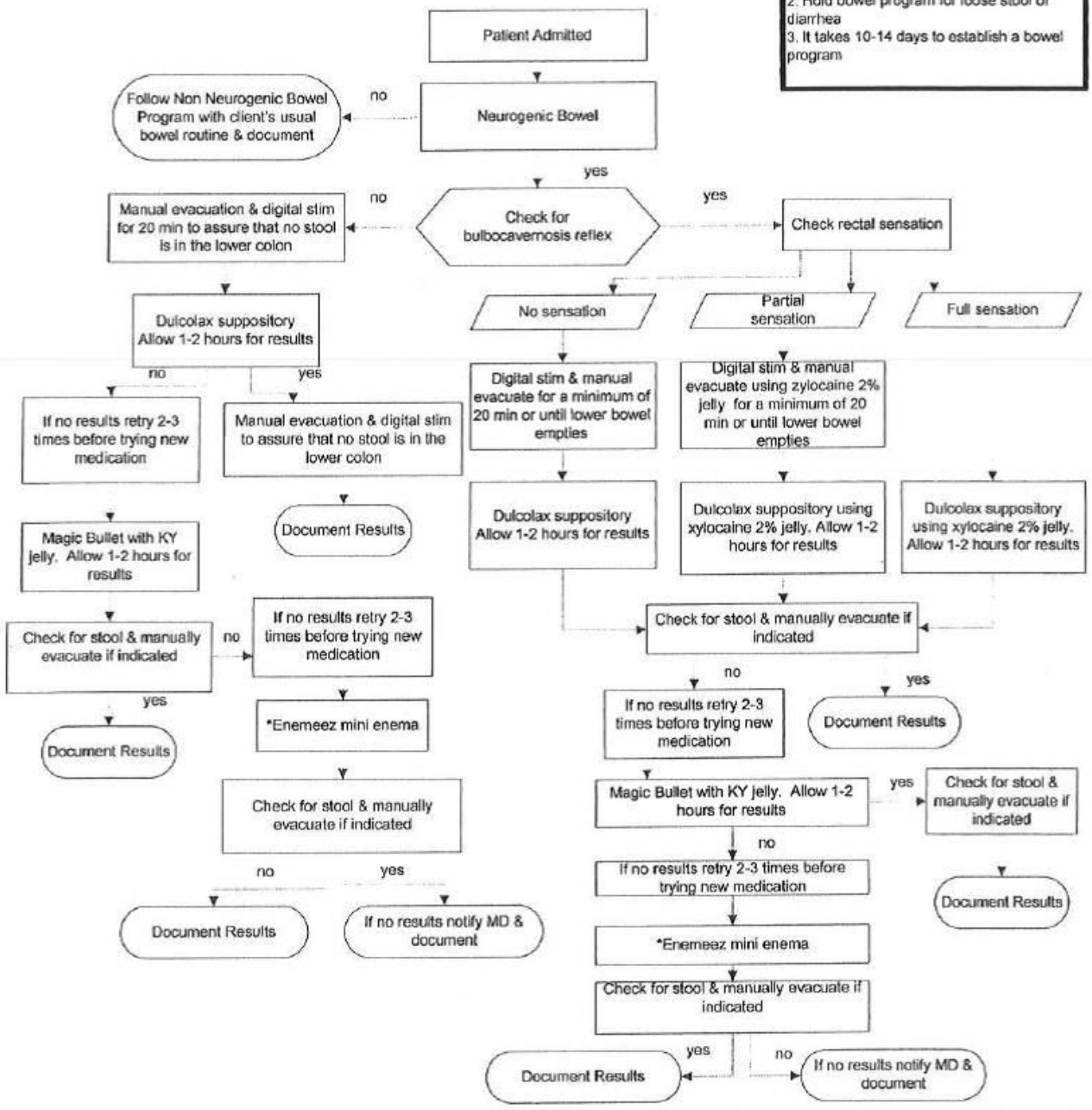
Orlando Regional Rehabilitation Institute

Nursing bowel Training Flow Chart

Note:
1. Pt. should be on oral stool softners to allow for formed stool .
2. Hold bowel program for loose stool or diarrhea
3. It takes 10-14 days to establish a bowel program



- Note: digital stimulation is performed by inserting index finger to the first bend in client's rectum and rotating finger in clockwise motion
- Manual evacuation = using index finger, remove stool from the lower bowel
- Document the stool amount, the consistency and odor and the amount of assistance given by the patient
- No patient especially spinal cord patients should be allowed to have unsuccessful bowel programs for more than 48-72 hours. If they do not have autonomic dysreflexia, which is very likely to occur, use 3 Dulcolax tablets or magnesium citrate to clean them out immediately
- All documentation should be in sunrise on the bowel program and assessment flow sheet or on the bowel program training form and daily flow sheet
- If a patient is having accidents, the bowel program is not effective. Discuss with MD.
- After an accident have patient return to room to stimulate and empty bowel.
- Try all suppositories for 2-3 programs before changing to another
- *If patient experiencing pain and/or dysreflexia with bowel program, use Enemeez Plus mini enema which includes an analgesic

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	Phase 1 - Critical Care Unit	Phase 2 – Step-down or Med/Surg

Nutrition
Goals:
• Maintain or improve nutritional status
• Minimize weight loss
	• Consult Speech Therapy for swallow evaluation prior to initiating oral intake in any SCI patient with cervical spinal cord injury, prolonged intubation, tracheostomy, Halo fixation, or after any cervical spine surgery.
	• Obtain feeding access and initiate enteral support within 48 hrs
	• Dietitian consult for intervention to assess for calorie and protein needs
	• Consider metabolic cart and 24 hr urine studies
	• Maintain euglycemia (blood glucose < 180 mg/dL)
	  ○ Bedside glucose Q 4 hrs on enteral nutrition
	  ○ Bedside glucose AC/HS on oral diet
		• Continue current diet orders
		• Dietitian to continue to monitor/intervene as per consult
		• Transition to oral diet with oral supplements when passes swallow study for tracheostomy patients
		• Discontinue sliding scale insulin & bedside glucose measurements if all < 180 mg/dL x 24 hrs on full enteral or oral diet

Bladder Goals: • No CAUTI • Prevent autonomic dysreflexia	• Insert urinary catheter due to neurogenic bladder • Consider removing urinary catheter when no longer on IVF, total intake is no more than 2 L/24 hrs, and no diuresis is present • Begin routine straight catheterization Q 4-6 hrs • Goal is to obtain no more than 400 ml per straight cath • Condom catheter is not recommended • Bladder scanning only recommended for any spontaneous voids in between straight catheter regimen	• Continue Phase I • Assess patient readiness to learn self-straight catheterization daily

Skin Care/Prevention
Goals:
• Place appropriate cervical collar
• Prevent pressure ulcers
	• Cervical collar
	  ○ Remove EMS collar
	  ○ Place Aspen Vista cervical collar or as ordered per neurosurgery
	  ○ Cervical collar care per Orlando Health standard
	• Consult Wound Management
	• Initiate the Pressure Ulcer Prevention Order Set
	• Apply Prevalon boots to bilateral lower extremities – remove Q-shift and moisturize skin
	• Place Mepilex sacral silicon dressing to coccyx/sacrum – reassess Q shift and change Q 3-5 days and prn
		• Continue current skin care measures
		• Low air loss/pressure redistribution mattress or as determined by the interdisciplinary team for function and prevention
		• Consult Wound Management for possible specialty bed if concerned for skin breakdown

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	Phase 1 - Critical Care Unit	Phase 2 – Step-down or Med/Surg

PT/OT/ST Rehabilitation & Mobility Plan
Goals:
• Increase functional ability
• Minimize contractures, etc.
	• Consult PT/OT/ST
	• Obtain proper environmental controls
	• Post Education sheets in room
	• ASIA score documentation
	• Out of bed to wheelchair (W/C) Q 24 hrs when managing physicians & neurosurgery approves and as patient tolerates
	  ○ Roho cushion at all times in chair when OOB
	  ○ Pressure relief protocol when patient in W/C (recline fully every 30 minutes for 60 seconds and return to full upright)
	• Passy Muir Valve (PMV) trials as soon as patient can tolerate even short periods of wear (or in-line PMV)
	• Participate in family meetings
	• Chest PT when patient sitting on edge of bed
		• PT/OT to assess need for orthotics for UE/LE
		• Respiratory & ST to assess need for in-line PMV

VTE Prevention Goal: • Prevent VTE	• SCD's to bilateral lower extremities while in bed • Initiate unfractionated heparin on admission - Heparin 5000 units SQ Q 8 hrs (7500 units if BMI ≥ 35) • Transition to enoxaparin 72 hrs post-operative or immediately if non-operative • Consider IVC filter placement for high risk patients that are unable to receive chemical prophylaxis– no quad coughing for 3 days after placement	• Continue SCDs while in bed • Continue chemical DVT prophylaxis
Psychosocial Goal(s): • Foster effective coping strategies • Provide SCI education to patient & family	• Consult Clinical Psychosocial Counseling • Consult Chaplain • Consult Music Therapy • Provide patient & family with a packet on SCI education, communication, and steps of grief • Ensure proper call bell is within reach at all times	• Complete a baseline assessment of coping skills/ adjustment to injuries • Show Understanding Spinal Cord Injury video • Child life for patient (if <18 yrs) or family (if siblings) • Pet Therapy • Volunteer Services for distraction • Adaptive equipment • Promote rest between midnight and 0600

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	Phase 1 - Critical Care Unit	Phase 2 – Step-down or Med/Surg
Pain/Spasticity Treatment Goals: • Attain adequate pain control • Minimize side effects associated with analgesic agents • Decrease post-SCI spasticity • Improve participation with PT/OT/ST/ADL	**Monitoring Parameters** • Pain score via visual/analogue scale or CPOT • Spasticity – compliance with PT/OT **Pain** ***Neuropathic Pain*** • Gabapentin 300 mg PO/PT Q 8 hrs; start at 100 mg PO/PT Q 8 hrs age > 65 years (maximum dose 2400 mg/d) OR • Pregabalin 75 mg PO Q 12 hrs, may increase to max 300 mg PO Q 12 hrs over 1-2 weeks (adjust for renal dysfunction) *Consider the following if also treating depression:* • Amitriptyline 25 mg PO Q HS, may increase to max 100 mg over 1 week ***Generalized Pain*** *Mild pain:* • Acetaminophen 650 mg PO/PT/PR Q 6hrs prn pain *Moderate pain:* • Enteral: Lortab elixir 10-15 ml PT Q 4 hrs prn pain • PO: Hydrocodone 5/325 mg 1-2 PO Q 4 hrs prn pain *Severe pain:* • Enteral: Oxycodone 5-10 mg PT Q 4 hrs prn pain • PO: Percocet 5/325 mg 1-2 PO Q 4 hrs prn pain **Spasticity** • Baclofen 10 mg PO TID (while awake) – max 120 mg/day **Muscle Relaxants** • Tizanadine (Zanaflex®) 2 mg PO Q 8 hrs (max: 36 mg/day) • Methocarbamol (Robaxin®) 750-1000 mg PO/IV Q 8 hrs	**Monitoring Parameters** • Same as Phase 1 **Pain** ***Neuropathic Pain*** • Continue to titrate medication as needed to specified maximum doses; if symptoms improve, consider weaning • Gabapentin and pregabalin should be weaned off over 1-2 weeks before discontinuing ***Generalized Pain*** • If severe, intractable pain, may increase opioid dose – the goal, however, is to achieve control with lowest possible dose • Continue current therapy with the goal to wean or discontinue opioids and/or benzodiazepines as quickly as possible to minimize respiratory & GI side effects • De-escalate patients (EX: from Percocet → tramadol) as soon as possible **Spasticity** • Monitor response to therapy (flexibility, ability to participate in PT/OT) • Initiate or titrate therapy as appropriate per Phase 1 recommendations *If no response to baclofen:* • Dantrolene 25 mg PO Q 24 hrs – may titrate every 7 days to a max of 400 mg/day **Muscle Relaxants** • Continue current therapy • Monitor response to therapy • Titrate to lowest possible dose

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	Phase 1 - Critical Care Unit	Phase 2 – Step-down or Med/Surg
D/C Planning/Consults Goals: • Decrease readmissions • Increase capture rate • Decrease length of stay	• Consult Care Coordinator on admission • Educate patient and family on goals/progress/plan • SCI team huddle weekly ○ Address on-going patient, family, and interdisciplinary team issues to better facilitate SCI patient care ○ Educate patient & family on goals, progress, plan ○ Prior to transfer from one level of care to another, incorporate team members from the next level	• Continue discharge planning • SCI team huddle weekly (CNS / CNL Trauma-Stepdown to coordinate) ○ Address on-going patient, family, and interdisciplinary team issues to better facilitate SCI patient care ○ Educate patient & family on goals, progress, plan ○ Prior to transfer from one level of care to another, incorporate team members from the next level

REFERENCES

General References

1. Fehlings MG, Tetreault LA, Wilson JR, et.al. A clinical practice guideline for the management of acute spinal cord injury: introduction, rationale, and scope. *Global Spine J.* 2017;7(3S):84S-94S.
2. Guidelines for the management of acute cervical spine and spinal cord injuries. American Association of Neurological Surgeons and Congress of Neurological Surgeons. *Neurosurgery*. 2013;72(2). Available at https://www.cns.org/guidelines/guidelines-management-acute-cervical-spine-and-spinal-cord-injuries. [Accessed 10 September 2018].
3. Early acute management in adults with spinal cord injury: a clinical practice guideline for health-care professionals. Consortium for Spinal cord Medicine Clinical Practice Guideline. *Paralyzed Veterans of America.* www.pva.org © 2008. [Accessed 26-May-2011].
4. Hadley MN, Walters BC, Arabi B, et.al. Chapter 4: Clinical assessment following acute cervical spinal cord injury. *Neurosurgery.* 2013;72:40-53.
5. Ball PA. Critical care of spinal cord injury. *Spine.* 26(24):S27-S30.
6. ASIA Standard Neurological Classification of Spinal cord Injury. Available at: http://boneandspine.com/wp-content/uploads/2009/08/asia-score-chart.png
7. Chikuda H, Yasunaga H, Takeshita K, et.al. Mortalitiy and morbidity after high-dose methylprednisolone treatment in patients with acute cervical spinal cord injury: a propensity-matched analysis using a nationwide administrative database. *Emerg Med J.* 2014;31:201-6.
8. Fehlings MG, Wilson JR, Tetreault LA, et.al. A clinical practice guideline for the management of patients with acute spinal cord injury: recommendations on the use of methylprednisolone sodium succinate. *Global Spine J,* 2017;7(3S):203S-211S.
9. Hurlbert RJ, Hadley MN, Walters BC, et.al. Chapter 8: Pharmacological therapy for acute spinal cord injury. *Neurosurgery.* 2013;72:93-105.

Respiratory System

10. Respiratory management following spinal cord injury: a clinical practice guideline for health-care professionals. Consortium for Spinal Cord Medicine Clinical Practice Guideline. *Paralyzed Veterans of America.* www.pva.org. © 2005. [Accessed 26-May-2011].
11. Berney S, Bragge P, Granger C, .et.al. The acute respiratory management of cervical spinal cord injury in the first 6 weeks after injury: a systematic review. *Spinal Cord.* 2011; 49:17-29.
12. Grimm DR, Schilero GJ, Spungen AM, et.al. Salmeterol improves pulmonary function in persons with tetraplegia. *Lung.* 2006; 184:335-9.
13. Browne JA, Evans D, Christmas LA, et.al. Pursuing excellence: development of an oral hygiene protocol for mechanically ventilated patients. *Crit Care Nurse Q.* 2011;34(1):25-30.
14. Ipratropium/albuterol. Lexi-Comp © 2011. [Accessed 06-06-2011].

15. Houtmeyers E, Gosselink R, Gayan-Ramirez G, et.al. Effects of drugs on mucus clearance. *Eur Respir J.* 1999; 14:452-67.
16. Package-Insert: Acetylcysteine inhalation solution, 10 & 20%. Hospira. © 2004.
17. Poppe JK: Clinical experiences with acetylcysteine as a mucolytic agent. *Dis Chest.* 1964; 46:66.
18. Miller WF: Aerosol therapy in acute and chronic respiratory disease. *Arch Intern Med*. 1973; 13:148.
19. Hirsch SR & Kory RC: An evaluation of the effect of nebulized N-acetylcysteine on sputum consistency. *J Allergy*. 1967; 39:265.

Cardiovascular
20. Ryken TC, Hurlbert RJ, Hadley MN, et.al. Chapter 7: The acute cardiopulmonary management of patients with cervical spinal cord injuries. *Neurosurgery.* 2013; 72:84-92.
21. Saadeh YS, Smith BW, Joseph JR, et.al. The impact of blood pressure management after spinal cord injury: a systematic review of the literature. *Neurosurg Focus.* 2017; 43:E20.
22. Readdy WJ, Whestone WD, Ferguson AR, et.al. Complications and outcomes of vasopressor usage in acute traumatic central cord syndrome. *J Neurosurg Spine.* 2015; 23:574-80.
23. Readdy WJ, Saigal R, Whetsone WD, et.al. Failure of mean arterial pressure goals to improve outcomes following penetrating spinal cord injury. *Neurosurgery.* 2016; 79:708-14.
24. Catapano JS, Hawryluk GWJ, Whetstone W,et.al. Higher mean arterial pressure values correlate with neurological improvement in patients with initially complete spine cord injuries. *World Neurosurg.* 2016; 96:72-9.
25. Rollstin A, Carey MC, Doherty G, et.al. Oral albuterol to treat symptomatic bradycardia in acute spinal cord injury. *Intern Emerg Med.* 2016; 11:101-5.
26. Evans CH, Duby JJ, Berry AJ, et.al. Enteral albuterol decreases the need for chronotropic agents in patients with cervical spinal cord injury – induced bradycardia. *J Trauma Acute Care Surg.* 2014; 76:297-302.
27. Agrawal A, Timothy J, Cincu R, et.al. Bradycardia in neurosurgery. *Clin Neurol Neurosurg*. 2008; 110:321-7.
28. Franga DL, Hawkins ML, Medeiros RS, et.al. Recurrent asystole resulting from high cervical spinal cord injuries. *Am Surg.* 2006;72(6):S25-29

Neurogenic Shock
29. Furlan JC, Fehlings MG. Cardiovascular Complications after Acute Spinal Cord Injury: Pathophysiology, Diagnosis, and Management. Neurosurg Focus. 2008;25(5):E13.
30. McMahon D, Tutt M, Cook AM. Pharmacological Management of Hemodynamic Complications Following Spinal Cord Injury. Orthopedics. 2009 May;32(5):331.
31. Early Acute Management in Adults with Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals. J Spinal Cord Med. 2008;31(4):403-79.

Gastrointestinal System
32. Dhall SS, Hadley MN, Arabi B, et.al. Chapter 22: Nutritional support after spinal cord injury. *Neurosurgery.* 2013; 72:255-9.
33. Neurogenic bowel management in adults with spinal cord injuries. Consortium for Spinal Cord Medicine Clinical Practice Guideline. *Paralyzed Veterans of America.* www.pva.org. © 1998. [Accessed 18-July-2011].
34. Han TR, Kim JH, Kwon BS. Chronic gastrointestinal problems and bowel dysfunction in patients with spinal cord injury. *Spinal Cord.* 1998; 36:485-90.
35. Harari D, Sarkarati M, Gurwitz JH, et.al. Constipation-related symptoms and bowel program concerning individuals with spinal cord injury. *Spinal Cord.* 1997; 35:394-401.

Pain Management
36. Teasell RW, Mehta W, Aubut JL, et.al. A systematic review of pharmacologic treatments of pain after spinal cord injury. *Arch Phys Med Rehabil.* 2010; 91:816-31.
37. Yelnik AP, Simon O, Bensmail D, et.al. Drug treatments for spasticity. *Ann Phys Rehabil Med*. 2009 ;52:746-56.

38. Acute management of autonomic dysreflexia: individual with spinal cord injury presenting to health-care facilities. Consortium for Spinal Cord Medicine Clinical Practice Guideline. *Paralyzed Veterans of America.* www.pva.org. © 2005. [Accessed 26-May-2011].

DVT Prophylaxis

39. Fehlings MG, Tetreault LA, Arabi B, et.al. A clinical practice guideline for the management of patients with acute spinal cord injury: recommendations on the type and timing of anticoagulant thromboprophylaxis. *Global Spine J.* 2017;7(3S):212S-220S.
40. Dhall SS, Hadley MN, Gelb DE, et.al. Chapter 21: Deep venous thrombosis and thromboembolism in patients with cervical spinal cord injuries. *Neurosurgery.* 2013; 72:244-54.
41. DiGiorgio AM, Tosolinas R, Alazzeh M, et.al. Safety and effectiveness of early chemical deep venous thrombosis prophylaxis after spinal cord injury: pilot prospective data. *Neurosurg Focus.*2017; 43; 5:E21.
42. Khan M, Jehan F, O'Keefe T, et.al. Optimal timing of initiation of thromboprophylaxis after nonoperative blunt spine trauma: a propensity-matched analysis. *J Am Coll Surg.* 2018; 226:760-8.
43. Chiou-Tan FY, Garza h, Chan KT, et.al. Comparison of dalteparin and enoxaparin for deep venous thrombosis prophylaxis in patients with spinal cord injury. *Am J Phys Med Rehabil.* 2003; 82(9):678-85.
44. Worley S, Short C, Pike J, et.al. Dalteparin vs low-dose unfractionated heparin for prophylaxis against clinically evident venous thromboembolism in acute traumatic spinal cord injury: a retrospective cohort study. *J Spinal Cord Med.* 2008; 31:379-87.
45. Slavik RS, Chan E, Gorman SK, et.al. Dalteparin versus enoxaparin for venous thromboembolism prophylaxis in acute spinal cord injury and major orthopedic trauma patients: 'DETECT' trial. *J Trauma.* 2007; 62:1075-81.
46. Velmahos GC, Kern J, Chan LS, et.al. Prevention of venous thromboembolism after injury: an evidence-based report – part 1: analysis of risk factors and evaluation of the role of vena caval filters. *J Trauma.* 2000; 49:132-9.
47. Velmahos GC, Kern J, Chan LS, et.al. Prevention of venous thromboembolism after injury: an evidence-based report – part 2: analysis of risk factors and evaluation of the role of vena caval filters. *J Trauma.* 2000; 49:140-44.
48. Harris S, Chen D, Green D. Enoxaparin for thromboembolism prophylaxis in spinal injury: preliminary report on experience with 105 patients. *Am J Phys Med Rehab.* 1996; 75(5):326-7.
49. Prevention of venous thromboembolism in the acute treatment phase after spinal cord injury: a randomized, multicenter trial comparing low-dose heparin plus intermittent pneumatic compression with enoxaparin. Spinal Cord Injury Thromboprophylaxis Investigators. *J Trauma.* 2003; 54:1116-26
50. Prevention of venous thromboembolism in the rehabilitation phase after spinal cord injury: prophylaxis with low-dose heparin or enoxaparin. Spinal Cord Injury Thromboprophylaxis Investigators. *J Trauma.* 2003; 54:1111-5

Surgical Critical Care Evidence-Based Medicine Guidelines Committee

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الجمهورية العربية السورية القيادة العامة للجيش والقوات المسلحة ادارة الخدمات الطبية	استمارة التدقيق السريري للمرشد تدبير الأذيات الحادة النخاع الشوكي	

الاسم :	الهاتف :
العمر :	الجنس :

		نعم	لا	ملاحظات
1	هل تم إجراء التنبيب و التهوية الآلية للمرضى حسب توصيات المرشد			
2	هل تمالالتزام بعدم إعطاء جرعة عالية من الميتيل بريدنيزولون			
3	هل تم إجراء الوقاية الكيماوية حسب توصيات المرشد			
4	هل تم استخدام النورأدرينالين حسب توصيات المرشد			
5	هل تم إجراء تخفيض الضغط جراحيا حسب توصيات المرشد			
6	هل تم إجراء خزع رغامى حسب توصيات المرشد			
7	هل تم البدء بالتأهيل الباكر للمريض حسب توصيات المرشد			

الطبيب المقيم

الطبيب الأخصائي