SAFETY

simulation for medical practice

SIMULATION APPROACH FOR EDUCATION AND TRAINING IN EMERGENCY

Musculoskeletal Trauma

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DOCUMENT VERSION 01

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Sim-Scenario

Musculoskeletal Injury, Acute Compartment Syndrome (ACS)

Scenario Description

Learning Target	Description	Participants
Medical: - diagnose ACS of extremities based on the history, physical examination findings and lab results - consider other diagnostic tools such as an intra-compartmental pressure monitoring device and/or near-infrared spectroscopy (NIRS) - acknowledge ACS as a surgical emergency and call for immediate surgical evaluation - when needed, optimize hemodynamics to ensure adequate limb perfusion before proceeding to a definitive surgical management (fasciotomy) CRM: - understand the importance of interdisciplinary communication - effective teamwork to deliver a quick diagnosis and decide the next best move in patient management	Where: - high-dependency unit (HDU Frame conditions: Day shift, all ressources available	- 3-4 participants 1-2 doctors, 2 nurses (all students). - The surgeon on call as backup (confederate)

Notes:

Sim-Scenario

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Scenario Briefing

Briefing (everyone)	Additional Briefing (individual Positions)	Case Briefing (Roleplayers)
John is a 30-year-old male adult who suffered a crush injury of his left lower limb (calf) while climbing and being trapped against a boulder for 4 hours until rescued Confused, dehydrated, and in pain, he gets admitted to HDU. A wait-and-see approach is endorsed encompassing fluid resuscitation, pain relief with iv drugs and regional techniques. X-ray showed no fracture Lab studies show initial moderate rhabdomyolysis. After initial improvement, the patient becomes restless.	Patient: -Patient reports lower limb burning pain sensation -Agitated -if extremity is stretched, pain is worse -reduced sensibility in lower left limb	Nurse – informs on pain, confusion and agitation; should be ready to provide labs, X ray and details about pain management – NSAIDS, paracetamol, regional analgesia. Surgeon – only if medical problem is unidentified or identified too quickly (see below). **Trainers background info:** A left lower limb compartment syndrome causes further deterioration. Surgery is the ultimate life-saving intervention that must be endorsed without further delay. Meanwhile, hemodynamic optimization is warranted to avoid regional ischaemia.

Notes:

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Script Sim Nurse/Co-Instructor

List of Material	Set-Up Room	Set-Up Simulator
- fluids - pumps - standard monitoring - NIRS monitoring - Intracompartmental pressure monitoring device with digital display and possibility to control it remotely	- high-dependency unit	- SimMan 3G or TraumaHal Gaumard - - - - - - - - - -

Notes:

Sim-Scenario

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Scenario Saver

How to react if the medical problem is n identified	How to react if the medical problem is identified too quickly	Other comments, material needed for savers (e.g. white coa
Surgeon (roleplayer) comes to reassess patient. Asks patient about paresthesias, pain dynamics, and eventually raises the question of whether to do surgery or not for limb decompression.	Surgeon (roleplayer) should then discuss the arguments supporting Acute Compartment Syndrome diagnosis. However, do not unnecessarily delay a good team.	

Notes:

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Scenario End Criteria

Scenario ends when…	Expected actions during initial	Case story

- Acute Compartment Syndrome is recognized - hemodynamics are optimized - surgical evaluation is asked for	**assessment and treatment:** - physical examination - check pain dynamics - check pain with stretching - check sensation - check blood-gas - check biochemistry - check X-ray - **may** compare NIRS values for both lower limbs - **may** ask for intracompartmental pressure monitoring device with digital display - check and compare dorsalis pedis pulses - iv fluids - norepinephrine to aim for MAP 65 mmHg - **may** ask for POCUS - call surgical evaluation	- initial clinical examination: equally warm lower limbs, good peripheral pulses, similar pulse oximetry plethysmographic waveform amplitude between the lower limbs - dressing for puncture wound with minimal contamination; received antibiotics -responded well to initial management: intravenous fluids, ice-packs, pain relief with NSAIDS, paracetamol, and US-guided saphenous (adductor) and sciatic-popliteal nerve block with 0.2% ropivacaine and dexamethasone 4mg/20ml -pain rebounds under nerve blockade, is extreme and described as deep and burning, and increases with passive stretch -unequal plethysmographic amplitudes -patient describes paresthesia - lab studies show worsened rhabdomyolysis

Notes: Don't let the patient die!

General note – end the scenario saying:

"The patient is now going to be taken care of, thank you for solving the case"

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Simulator Set-Up, Steering

(duplicate this page if necessary)

	Phase 1	Phase 2

	Initial and management phase	
Vitals	HR: 128/min, Sinus thythm BP: 75/40 mmHg SpO2: 98% with 4l/O2 *(CO2: 28 mmHg)* Resp. Rate: 28/min Temp: 37.8	HR: 114/min, Sinus rhythm BP: 93/52 SpO2: 98% with 4l/O2 *(CO2: 30 mmHg)* Resp. Rate: 26/min Temp: 37.8
Text for patient	-Patient reports lower limb pain. -Agitated (RASS +1, +2) -if asked about type of pain, J.F. reports burning pain -if LLL is stretched, J.F. reports worsened pain -if sensibility is checked for, J.F. reports diminished LLL sensibility	Same as before
Other info	**Critical actions:** Recognising the emergency Call for surgical evaluation	
Management during scenario		

Notes: Initial evaluation. Biochemistry outstanding: CK 4000 U/L; all other values are within normal range. NIRS values: LLL 35% and RLL 56%. X-ray shows no fracture. BGA: lactate of 3.5 mmol/L; CO2 of 28 mmHg; HCO3 of 19mEq/L; pH of 7.45. Compartment pressure: 32 mmHg. If POCUS asked for, then show hyperdynamic empty chambers and collapsible inferior vena cava. LLL dorsalis pedis pulse << RLL dorsalis pedis pulse.

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Abstract

Learning Target:	Recognition and management of Acute Compartment Syndrome
Description:	Traumatic Compartment Syndrome, worsening in ED
Participants:	1-2 doctors, 2 nurses (all students).

Case Briefing:	Young man, mountaineering accident, crush injury of lower left limb, pain rebounding despite management
List of Material:	intracompartmental pressure monitoring device with digital display
Set-Up Room	High dependency unit
Set-Up Simulator:	Simulator with appropriate moulage
Scenario Saver:	Surgeon
Scenario End Criteria:	Surgical evaluation after recognition of Acute Compartment Syndrome
Management during Scenario:	
Other:	

Notes: