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| **Maryland Next Gen NCLEX Test Bank Project**  **September 1, 2022** | | | |
| **Case Study Topic**:  (& standalone trend) | Compartment Syndrome | **Author:** | Dawn Leukhardt, MSN, RN  College of Southern Maryland  LaPlata, Maryland |

**Case Summary**

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| 23-year-old female client is admitted to the Medical-Surgical unit from the Post Anesthesia Care Unit following an open reduction and internal fixation for a compound fracture of the right tibia and fibula with application of a fiberglass cast. The right lower extremity is casted from the knee down, leaving the toes exposed. The client develops neurovascular changes consistent with compartment syndrome. |

**Objectives**

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| 1. Identify the components of a neurovascular assessment.  2. Differentiate between acute and chronic complications related to fracture.  3. Recognize signs of neurovascular compromise related to compartment syndrome.  4. Identify changes in assessment data from trends.  5. Delegate care to the unlicensed assistive personnel appropriately.  6. Evaluate effectiveness of interventions on neurovascular status. |

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| --- | --- |
| **Case Study Link** | **Case Study QR Code** |
| <https://umaryland.az1.qualtrics.com/jfe/form/SV_eX9s0hwdlD6QpBI> |  |
| **Trend QR Code** | **Trend Link** |
|  | <https://umaryland.az1.qualtrics.com/jfe/form/SV_eIZJdMF4fvnMRPE> |

**Case References**

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| 1. Bruner and Suddarth (2022) Textbook of Medical-Surgical Nursing 15th Edition |

**Case Study Question 1 of 6**

The nurse is caring for a 23-year-old female client admitted to the medical-surgical unit following surgery for a compound fracture of the right tibia and fibula.

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| **Nurses’ Notes** | | |
| 0830: Admitted from Post Anesthesia Care Unit following surgery to repair an open fracture with internal fixation with application of a fiberglass cast. R lower extremity elevated. IV infusing as ordered. Client medicated for pain prior to transport. Vital Signs BP 110/72, HR 90, RR 29, Temp 99F (37.2C).Unable to assess pedal pulse on R lower extremity due to cast. Motion of toes limited by pain and cast. Will monitor for signs of acute complications.  0930: Client resting at this time. Will continue to monitor.  1100: Client reporting pain 10/10 in R lower extremity. Updated neurovascular checks. | | | | | | | | |
| **Neurovascular Flowsheet** | | |
| Right Lower Extremity | **Pain Score**  0-10/10 | **Motion**  F = full  L = limited  N = none | | **Sensation**  F = full  P = partial  N = none | **Capillary Refill**  B = brisk < 3 seconds  S = sluggish > 3 seconds | **Color**  N = normal  P = pale  D = dusky  C = cyanotic | **Warmth**  H = hot  W = warm  T = tepid  C = cold | **Pulse**  4+ bounding  3+ increased  2+ normal  1+ weak  0 absent  UTA unable to assess | |
| Time: |
| 0830 | 3/10 | L | | F | B | N | W | UTA | |
| 0930 | 3/10 | L | | F | B | N | W | UTA | |
| 1030 | 4/10 | L | | F | B | N | W | UTA | |
| 1100 | 10/10 | N | | N | S | P | T | UTA | |
| **Orders** | | |
| 0830: **Admission Orders**:   * Bedrest with right leg elevated on 2 pillows * May use bedside commode with assistance, no weight bearing to R lower extremity * Advance to Regular diet as tolerated * VS and neurovascular checks every hour for 4 hours then every 4 hours | | | | | | | | | |

The nurse is performing a neurovascular assessment of the right lower extremity.

* Which findings require **immediate** follow-up? Select all that apply
* Toes on the affected extremity are cool to the touch\*
* Unable to palpate pedal pulses on the right leg
* Right toes have noticeable pallor compared to the left\*
* Client describes absent sensation of the right lower leg\*
* Capillary refill greater than 3 seconds to right toes\*
* Client reports pain of 10/10 to R lower extremity\*

**Scoring Rule: +/-**

**Rationale:** Primary signs of compartment syndrome include the “5 P’s,” **P**ain (out of proportion/not relieved with pain medication), **P**allor, **P**ulses (diminished or absent), **P**aresthesia, **P**aralysis. Additionally, fullness, cool or cold extremity, and weakness may occur. Any of these symptoms are indicative of neurovascular compromise. If untreated could result in tissue death and loss of limb. The pedal pulse will not be able to be assessed due to the cast.

**Case Study Question 2 of 6**

The nurse is caring for a 23-year-old female client admitted to the medical-surgical unit following surgery for a compound fracture of the right tibia and fibula.

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| **Nurses’ Notes** | | |
| 0830: Admitted from Post Anesthesia Care Unit following surgery to repair an open fracture with internal fixation with application of a fiberglass cast. R lower extremity elevated. IV infusing as ordered. Client medicated for pain prior to transport. Vital Signs BP 110/72, HR 90, RR 29, Temp 99F (37.2C).Unable to assess pedal pulse on R lower extremity due to cast. Motion of toes limited by pain and cast. Will monitor for signs of acute complications.  0930: Client resting at this time. Will continue to monitor.  1100: Client reporting pain 10/10 in R lower extremity. Updated neurovascular checks. | | | | | | | | |
| **Neurovascular Flowsheet** | | |
| Right Lower Extremity | **Pain Score**  0-10/10 | **Motion**  F = full  L = limited  N = none | | **Sensation**  F = full  P = partial  N = none | **Capillary Refill**  B = brisk < 3 seconds  S = sluggish > 3 seconds | **Color**  N = normal  P = pale  D = dusky  C = cyanotic | **Warmth**  H = hot  W = warm  T = tepid  C = cold | **Pulse**  4+ bounding  3+ increased  2+ normal  1+ weak  0 absent  UTA unable to assess | |
| Time: |
| 0830 | 3/10 | L | | F | B | N | W | UTA | |
| 0930 | 3/10 | L | | F | B | N | W | UTA | |
| 1030 | 4/10 | L | | F | B | N | W | UTA | |
| 1100 | 10/10 | N | | N | S | P | T | UTA | |
| **Orders** | | |
| 0830: **Admission Orders**:   * Bedrest with right leg elevated on 2 pillows * May use bedside commode with assistance, no weight bearing to R lower extremity * Advance to Regular diet as tolerated * VS and neurovascular checks every hour for 4 hours then every 4 hours | | | | | | | | | |

The nurse indicates “Will monitor for signs of acute complications.”

* For each potential complication of a fracture click to indicate if the complication is an acute complication or a chronic complication associated with fractures.

|  |  |  |
| --- | --- | --- |
| Complication | Acute Complication | Chronic Complication |
| Venous thromboembolism | * \* |  |
| Complex regional pain syndrome |  | * \* |
| Avascular necrosis |  | * \* |
| Osteomyelitis |  | * \* |
| Delayed union |  | * \* |
| Compartment syndrome | * \* |  |

**Scoring Rule: 0/1**

**Rationale:** The nurse should differentiate between acute complications of a fracture and chronic or late complications. Acute complications include deep vein thrombosis or pulmonary embolism, fat embolism, and compartment syndrome. Late, or chronic complications include complex regional pain syndrome, avascular necrosis, osteomyelitis, and delayed union.

**Case Study Question 3 of 6**

The nurse is caring for a 23-year-old female client admitted to the medical-surgical unit following surgery for a compound fracture of the right tibia and fibula.

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| **Nurses’ Notes** | | |
| 0830: Admitted from Post Anesthesia Care Unit following surgery to repair an open fracture with internal fixation with application of a fiberglass cast. R lower extremity elevated. IV infusing as ordered. Client medicated for pain prior to transport. Vital Signs BP 110/72, HR 90, RR 29, Temp 99F (37.2C).Unable to assess pedal pulse on R lower extremity due to cast. Motion of toes limited by pain and cast. Will monitor for signs of acute complications.  0930: Client resting at this time. Will continue to monitor.  1100: Client reporting pain 10/10 in R lower extremity. Updated neurovascular checks. | | | | | | | | |
| **Neurovascular Flowsheet** | | |
| Right Lower Extremity | **Pain Score**  0-10/10 | **Motion**  F = full  L = limited  N = none | | **Sensation**  F = full  P = partial  N = none | **Capillary Refill**  B = brisk < 3 seconds  S = sluggish > 3 seconds | **Color**  N = normal  P = pale  D = dusky  C = cyanotic | **Warmth**  H = hot  W = warm  T = tepid  C = cold | **Pulse**  4+ bounding  3+ increased  2+ normal  1+ weak  0 absent  UTA unable to assess | |
| Time: |
| 0830 | 3/10 | L | | F | B | N | W | UTA | |
| 0930 | 3/10 | L | | F | B | N | W | UTA | |
| 1030 | 4/10 | L | | F | B | N | W | UTA | |
| 1100 | 10/10 | N | | N | S | P | T | UTA | |
| 1115 | 10/10 | N | | N | S | P | T | UTA | |
| **Orders** | | |
| 0830: **Admission Orders**:   * Bedrest with right leg elevated on 2 pillows * May use bedside commode with assistance, no weight bearing to R lower extremity * Advance to Regular diet as tolerated * VS and neurovascular checks every hour for 4 hours then every 4 hours | | | | | | | | | |

The Neurovascular Assessment and Nurses’ Notes have been updated to reflect the current assessment findings.

* Complete the following sentence by choosing from the list of options.

|  |  |
| --- | --- |
| Based on the assessment findings the client is most likely experiencing | **Select**  Complex regional pain syndrome  Compartment syndrome\*  Delayed union  Avascular necrosis  Osteomyelitis |
| as most evidenced by | **Select** |
| Numeric Pain rate of 10/10 |
| Neurovascular assessment\* |
| Decreased mobility |
| Presence of fiberglass cast  Neurological assessment |

**Scoring Rule: Rationale**

**Rationale**: Compartment syndrome is suspected based on the abnormal findings in the neurovascular assessment. While some of the vital signs are abnormal, and the client is tachycardic there can be causes other than compartment syndrome for these findings.

**Case Study Question 4 of 6**

The nurse is caring for a 23-year-old female client admitted to the medical-surgical unit following surgery for a compound fracture of the right tibia and fibula.

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| **Nurses’ Notes** | | |
| 0830: Admitted from Post Anesthesia Care Unit following surgery to repair an open fracture with internal fixation with application of a fiberglass cast. R lower extremity elevated. IV infusing as ordered. Client medicated for pain prior to transport. Vital Signs BP 110/72, HR 90, RR 29, Temp 99F (37.2C).Unable to assess pedal pulse on R lower extremity due to cast. Motion of toes limited by pain and cast. Will monitor for signs of acute complications.  0930: Client resting at this time. Will continue to monitor.  1100: Client reporting pain 10/10 in R lower extremity. Updated neurovascular checks.  1115: Vital Signs BP 82/44, HR 112, RR 22, Temp 99F (37.2C). Provider notified of client changes. | | | | | | | | |
| **Neurovascular Flowsheet** | | |
| Right Lower Extremity | **Pain Score**  0-10/10 | **Motion**  F = full  L = limited  N = none | | **Sensation**  F = full  P = partial  N = none | **Capillary Refill**  B = brisk < 3 seconds  S = sluggish > 3 seconds | **Color**  N = normal  P = pale  D = dusky  C = cyanotic | **Warmth**  H = hot  W = warm  T = tepid  C = cold | **Pulse**  4+ bounding  3+ increased  2+ normal  1+ weak  0 absent  UTA unable to assess | |
| Time: |
| 0830 | 3/10 | L | | F | B | N | W | UTA | |
| 0930 | 3/10 | L | | F | B | N | W | UTA | |
| 1030 | 4/10 | L | | F | B | N | W | UTA | |
| 1100 | 10/10 | N | | N | S | P | T | UTA | |
| 1115 | 10/10 | N | | N | S | P | T | UTA | |
| **Orders** | | |
| 0830: **Admission Orders**:   * Bedrest with right leg elevated on 2 pillows * May use bedside commode with assistance, no weight bearing to R lower extremity * Advance to Regular diet as tolerated * VS and neurovascular checks every hour for 4 hours then every 4 hours | | | | | | | | | |

The nurse suspects the client is developing compartment syndrome and prepares for the provider to reassess the client.

* Based on the assessment findings and recent vital signs, select the orders from each of the categories the nurse would anticipate being included in the plan of care. Each category may have more than one order included.

|  |  |
| --- | --- |
| Categories | Orders |
| Nursing | * Change diet to nothing by mouth\* |
| * Place client in Trendelenburg position |
| * Cast removal saw to bedside STAT\* |
| * Order compartment pressure measurement device to bedside\* |
| Medication | * Administer morphine 4 mg IV push for pain\* |
| * Administer ibuprofen 400 mg by mouth stat |
| * Administer aspirin 325 mg by mouth every 12 hours |
| * Administer IV normal saline bolus of 500 mL over 30 minutes\* |
| Collaborative | * Physical therapy to instruct on crutch walking |
| * Initiate respiratory therapy protocol |
| * Case management to plan for long-term care placement |
| * Consult surgery team for possible fasciotomy\* |

**Scoring Rule: +/-**

**Rationale:** The nurse should prioritize interventions that would relieve pressure within the compartment, monitor for improving or declining condition, and treat potential life or limb threatening conditions. This would include frequent neurovascular assessments and preparing to remove the cast as soon as possible by getting the cast removal saw to the bedside. The provider is likely to insert a compartment pressure measurement manometer to assess compartmental pressures. Client should be kept NPO in the event surgery is required. Pain medication such as morphine is indicated, and due to hypotension an IV fluid bolus is indicated. Ibuprofen is not effective for the pain rate of 10/10, and 400 mg would not be a therapeutic dose. Aspirin is contraindicated due to the anticoagulation component if the client needs surgery. The surgical team should be consulted. Client would not be instructed on crutch walking at this time until the compartment syndrome is resolved. Respiratory and Case Management for long-term care are not indicated at this time.

**Case Study Question 5 of 6**

The nurse is caring for a 23-year-old female client admitted to the medical-surgical unit following surgery for a compound fracture of the right tibia and fibula.

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| **Nurses’ Notes** | | |
| 0830: Admitted from Post Anesthesia Care Unit following surgery to repair an open fracture with internal fixation with application of a fiberglass cast. R lower extremity elevated. IV infusing as ordered. Client medicated for pain prior to transport. Vital Signs BP 110/72, HR 90, RR 29, Temp 99F (37.2C).Unable to assess pedal pulse on R lower extremity due to cast. Motion of toes limited by pain and cast. Will monitor for signs of acute complications.  0930: Client resting at this time. Will continue to monitor.  1100: Client reporting pain 10/10 in R lower extremity. Updated neurovascular checks.  1115: Vital Signs BP 82/44, HR 112, RR 22, Temp 99F (37.2C). Provider notified of client changes. | | | | | | | | |
| **Neurovascular Flowsheet** | | |
| Right Lower Extremity | **Pain Score**  0-10/10 | **Motion**  F = full  L = limited  N = none | | **Sensation**  F = full  P = partial  N = none | **Capillary Refill**  B = brisk < 3 seconds  S = sluggish > 3 seconds | **Color**  N = normal  P = pale  D = dusky  C = cyanotic | **Warmth**  H = hot  W = warm  T = tepid  C = cold | **Pulse**  4+ bounding  3+ increased  2+ normal  1+ weak  0 absent  UTA unable to assess | |
| Time: |
| 0830 | 3/10 | L | | F | B | N | W | UTA | |
| 0930 | 3/10 | L | | F | B | N | W | UTA | |
| 1030 | 4/10 | L | | F | B | N | W | UTA | |
| 1100 | 10/10 | N | | N | S | P | T | UTA | |
| 1115 | 10/10 | N | | N | S | P | T | UTA | |
| 1130 | 10/10 | N | | N | S | D | T | UTA | |
| 1145 | 10/10 | L | | N | S | P | T | 1+ | |
| 1245 | 3/10 | L | | N | S | N | C | 0 | |
| **Orders** | | |
| 0830: **Admission Orders**:   * Bedrest with right leg elevated on 2 pillows * May use bedside commode with assistance, no weight bearing to R lower extremity * Advance to Regular diet as tolerated * VS and neurovascular checks every hour for 4 hours then every 4 hours.   1130: **STAT Orders**:   * Strict bedrest, maintain R leg at level of the heart * Assist client to use bedpan; Monitor intake and output * Keep client nothing by mouth until cleared * Document height and weight * Order cast cutting tray and compartment pressure measuring device to bedside * Check Neurovascular status and vital signs every 15 minutes for 2 hours * IV fluid bolus of 500 mL of normal saline over 30 minutes for blood pressure <100 mm Hg * Complete pre-operative checklist: Notify operating room to prepare for possible fasciotomy | | | | | | | | | |

The nurse has reviewed updated orders placed by provider.

* Which orders can the nurse delegate to the Unlicensed Assistive Personnel(UAP)? Select all that Apply.

|  |
| --- |
| * Check neurovascular status every 15 minutes for 2 hours |
| * Obtain vital signs every hour for 4 hours\* |
| * Assist client to use bedpan to void\* |
| * Complete pre-operative checklist |
| * Assist client to maintain right leg at the heart level\* |
| * Measure intake and output\* |
| * Document client’s height and weight\* |

**Scoring Rule: +/-**

**Rationale:** To accomplish all the tasks needed to care for this client the nurse may delegate some tasks to the UAP. The UAP is unable to perform assessments or monitor neurovascular status. t is the nurses’ responsibility to ensure client is ready for surgery. The pre-operative checklist may be used to ensure all pre-operative criteria is met. Measuring and documenting VS, Intake and Output, height and weight may all be done by the UAP. The UAP may also help the client to maintain the extremity in the proper position as instructed by the Nurse.

**Case Study Question 6 of 6**

The nurse is caring for a 23-year-old female client admitted to the medical-surgical unit following surgery for a compound fracture of the right tibia and fibula.

|  |  |  |
| --- | --- | --- |
| **Nurses’ Notes** | | |
| 0830: Admitted from Post Anesthesia Care Unit following surgery to repair an open fracture with internal fixation with application of a fiberglass cast. R lower extremity elevated. IV infusing as ordered. Client medicated for pain prior to transport. Vital Signs BP 110/72, HR 90, RR 29, Temp 99F (37.2C).Unable to assess pedal pulse on R lower extremity due to cast. Motion of toes limited by pain and cast. Will monitor for signs of acute complications.  0930: Client resting at this time. Will continue to monitor.  1100: Client reporting pain 10/10 in R lower extremity. Updated neurovascular checks.  1115: Vital Signs BP 82/44, HR 112, RR 22, Temp 99F (37.2C). Provider notified of client changes  1145: Cast removed at bedside, see updated flow sheet.  1245: Vital Signs BP 116/70, HR 88, RR 16, Temp 98.8 F(37.1C), pain 3/10. | | | | | | | | |
| **Neurovascular Flowsheet** | | |
| Right Lower Extremity | **Pain Score**  0-10/10 | **Motion**  F = full  L = limited  N = none | | **Sensation**  F = full  P = partial  N = none | **Capillary Refill**  B = brisk < 3 seconds  S = sluggish > 3 seconds | **Color**  N = normal  P = pale  D = dusky  C = cyanotic | **Warmth**  H = hot  W = warm  T = tepid  C = cold | **Pulse**  4+ bounding  3+ increased  2+ normal  1+ weak  0 absent  UTA unable to assess | |
| Time: |
| 0830 | 3/10 | L | | F | B | N | W | UTA | |
| 0930 | 3/10 | L | | F | B | N | W | UTA | |
| 1030 | 4/10 | L | | F | B | N | W | UTA | |
| 1100 | 10/10 | N | | N | S | P | T | UTA | |
| 1115 | 10/10 | N | | N | S | P | T | UTA | |
| 1130 | 10/10 | N | | N | S | D | T | UTA | |
| 1145 | 10/10 | L | | N | S | P | T | 1+ | |
| 1245 | 3/10 | L | | N | S | N | C | 0 | |
| **Orders** | | |
| 0830: **Admission Orders**:   * Bedrest with right leg elevated on 2 pillows * May use bedside commode with assistance, no weight bearing to R lower extremity * Advance to Regular diet as tolerated * VS and neurovascular checks every hour for 4 hours then every 4 hours.   1130: **STAT Orders**:   * Strict bedrest, maintain R leg at level of the heart * Assist client to use bedpan; Monitor intake and output * Keep client nothing by mouth until cleared * Document height and weight * Order cast cutting tray and compartment pressure measuring device to bedside * Check Neurovascular status and vital signs every 15 minutes for 2 hours * IV fluid bolus of 500 mL of normal saline over 30 minutes for blood pressure <100 mm Hg * Complete pre-operative checklist: Notify operating room to prepare for possible fasciotomy | | | | | | | | | |

The nurse follows up on tasks delegated to the unlicensed assistive personnel and reviews the vital signs and updates the neurovascular flowsheet to reflect the most recent assessment.

* For each finding, click to specify if the finding indicates that the client’s status has improved, declined, or is unchanged since the onset of symptoms.

|  |  |  |  |
| --- | --- | --- | --- |
| Finding | Improved | Declined | Unchanged |
| Pain | * \* |  |  |
| Motion | * \* |  |  |
| Sensation |  |  | * \* |
| Capillary Refill |  |  | * \* |
| Color | * \* |  |  |
| Warmth |  | * \* |  |
| Pulse |  | * \* |  |

**Scoring Rule: 0/1**

**Rationale:** The nurse determines the client’s Pain rate, motion and color are improving since the onset of symptoms (1100) as evidenced by the data in the neurovascular assessment. The pulse and temperature declined, and the sensation and capillary refill remained unchanged.

**Trend Template**

The nurse is caring for a 23-year-old female client admitted to the medical-surgical unit who developed compartment syndrome following surgery for a compound fracture of the right tibia and fibula.

|  |  |
| --- | --- |
| **Neurovascular Flowsheet:** | |
| Right Lower Extremity | **Pain Score** 0-10/10 | **Motion**  F = full  L = limited  N = none | **Sensation**  F = full  P = partial  N = none | **Capillary Refill**  B = brisk < 3 seconds  S = sluggish > 3 seconds | **Color**  N = normal  P = pale  D = dusky  C = cyanotic | **Warmth**  H = hot  W = warm  T = tepid  C = cold | **Pulse**  4+ bounding  3+ increased  2+ normal  1+ weak  0 absent  UTA unable to assess | |
| Time: |
| 1115 | 10/10 | N | N | S | P | T | UTA | |
| 1130 | 10/10 | N | N | S | D | T | UTA | |
| 1145 | 10/10 | L | N | S | P | T | 1+ | |
| 1200 | 6/10 | L | N | S | P | T | 1+ | |
| 1215 | 5/10 | L | N | S | P | T | 1+ | |
| 1230 | 5/10 | L | N | S | P | C | 1+ | |
| 1245 | 3/10 | L | N | S | P | C | 0 | |
| 1115: Neurovascular assessment completed. Vital Signs BP 82/44, HR 112, RR 22, Temp 99F (37.2C) pain increased to 10/10 to R lower extremity. Provider notified  1145: Cast removed at bedside, see updated flow sheet.  1245: Vital Signs BP 116/70, HR 88, RR 16, Temp 98.8 F(37.1C), pain 3/10. | | | | | | | |

The nurse reassesses the client every 15 minutes for 1 hour after cast removal.

* Complete the following sentence by choosing from the list of options.

|  |  |
| --- | --- |
| Based on the data, the nurse determines the client’s status is | **Select** |
| improving |
| deteriorating\* |
| unchanged |
| The nurse should now | **Select**  notify the physician\*  continue to monitor  administer pain medication |

**Scoring Rule: 0/1**

**Rationale:** While some of the assessment have remained unchanged the extremity has gotten increasingly cool to the touch and the pulse is now absent. These findings may necessitate further action, and the physician should be notified immediately in case the client will need a surgical fasciotomy to restore adequate perfusion to the affected extremity, as there is evidence neurovascular compromise is still present.