<table>
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<tr>
<th>Reference (include title, publication year, and journal)</th>
<th>Evidence level (I-VII)</th>
<th>Methods, key findings, outcomes or recommendations</th>
<th>Critical Appraisal of the Evidence (consider study design and scope, methodological strengths and weaknesses etc)</th>
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- Adequate documentation of neurovascular assessment includes capillary refill time, presence or absence of pulses, normal or abnormal motor and sensory function.  
- The analysis concluded inadequate documentation of neurovascular assessment throughout the hospital. Some areas documentation was less than adequate more than 50% of the time.  
- "Neurovascularly intact" is not accepted as adequate documentation of neurovascular status because of its ambiguity.  
- Documentation of assessment was similarly poor on the orthopedic ward.  
- Findings indicate that documentation of the opposite limbs neurovascular status is also not documented well.  
- If neurovascular status is compromised contact medical team  
- Outcomes include pre and post surgical documentation on neurovascular assessment is poor  
- Outlines upper limb neurovascular assessment  
- Outlines what adequate documentation should include  
- Outlines upper limb nerves and expected outcomes  
- No recommendations were mentioned in this study | - Strength: the article stated a clearly focused aim of the research and clearly stated the goal intended.  
- Strength: Method of the study was clearly stated  
- Strength: There is no bias in recruitment of participants because all participants suitable for inclusion were included in the study.  
- Strength: Documentation was taken in separate departments in the hospital allowing a larger scale on assessment  
- Strength: This study has 35 participants meaning it is a medium size scale study  
- Strengths: This study is primarily focused on the paediatric population. Population clearly outlined  
- Weakness: the conclusion of the study did not match up with the aim of the study. The results ended up being more focused on the documentation rather than the assessment of the fracture.  
- Weakness: Retrospective analysis leads to the reader’s interpretation of documentation, possibility of author bias and may be selective in what is included in the results.  
- Weakness: study relies on documentation of other nurses, not all documentation is accurate.  
- Weakness: This retrospective analysis was only undertaken at one institution meaning they only assessed one small population geographically, Cannot generalise to the whole population  
- No strengths or limitations were mentioned by the author |
- Compartment syndrome is the most common complication of neurovascular compromise  
- Definition of compartment syndrome  
- Early detection of neurovascular deterioration is vital in avoiding long-term disability  
- Assessment should be based on the 5 P’s pain, pulse, pallor, parasthesia and paralysis  
- Bilateral comparison of limbs should be obtained and documented for the purpose of a baseline assessment. | - This study is a literature review that does not state how many articles were reviewed. In 2009 a search was undertaken through four databases and an internet search with the search terms 'neurovascular assessment' and 'compartment syndrome.'  
- Strength: four databases were used in the search including CINAHL, Medline, PUBLMED and British Nursing Index, this could be assumed to be a large scale systematic review.  
- Strength: The aim of this study is clearly outlined and consistent with the conclusion  
- Strength: This was a well written literature review that maintained good direction  
- Strength: Primary author is a practicing paediatric nurse who is undertaking further study in orthopedic and fracture trauma. Expert experience in the field.  
- All articles assessed indicated that neurovascular assessment was consistent with assessing the 5P’s, this is consistent with other literature assessed |
- Pain assessment is an important part of neurovascular assessment and is the most valuable indicator of neurovascular compromise.
  - Validated pain assessment tools should be utilized.
  - Neurovascular assessment tools should be used due to their simplicity and are vital in determining neurovascular deterioration
  - Frequency of neurovascular assessment is not mentioned throughout literature.
  - Outcomes – neurovascular assessment should be based on the 5Ps, this assessment is consistent with assessing vascular status, movement, sensation and pain.
  - Outcome – pain is a reliable indicator for neurovascular deterioration
  - Outcome – throughout literature the frequency of undertaking neurovascular assessment is inconclusive
  - Recommendation – lack of literature on paediatric neurovascular assessment and availability of paediatric assessment tools, more information is needed for evidence base practice.
  - Recommendations that further studies should be conducted, particularly in providing more child friendly methods of assessment.

- Weakness: Few articles sourced are solely focused on paediatric nursing, broad population assessed
  - Level VII evidence
  - No strengths or limitations were mentioned in the study

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**Retrospective case series**


- Retrospective case series of all patients treated with an acute compartment syndrome following a fracture of the lower leg between the years 1998-2010.
  - Inclusion criteria includes less than eighteen years and complete documentation of the patients history
  - Exclusion criteria included compartment syndrome with absence of a fracture
  - Within a period of 12 years there were 1028 fractures of the lower leg were treated at the clinic and 31 patients developed compartment syndrome.
    - 28 male and 3 female
    - The occurrence was significantly lower in children less than 12 years ($P<0.02$) (1.3%).
    - The mean time from injury to diagnosis was 19 hours (range 1.5-65hours)
    - Post a high energy trauma compartment syndrome was often diagnosed by 17hours. However the difference in time between a high energy and low energy trauma was not statistically significant ($P = 0.14$)
    - 9 out of 31 participants were diagnosed solely on clinical symptoms

- Evaluation of statistical significance concerning the incidence of acute compartment syndrome the Chai square test was used and Mann Whitney U test assessed difference in times of occurrence.
  - Method, inclusion and exclusion criteria were clear. This avoids bias from author.
  - The article had a clearly focused introduction which was consistent with results and conclusion
  - Strength: The study focused solely of the paediatric population which was clearly outlined to be below the ages of eighteen. The Median age is 14.6 years old, this is a strength because the results can be generalised to the paediatric population
  - Weakness: study relies on documentation of other nurses and is done on the authors interpretation of notes
  - Weakness: It is unclear but appears the study was taken from one hospital which limits generalisation
  - Strength: There were 1038 fractures in the studies time period there were 31 participants who developed compartment syndrome. This is a large scale retrospective analysis.
  - Strength: This retrospective case analysis helps identify the time between injury and presence of complication which was statistically significant.
  - A limitation of this study is only children included in this study were those with compartment syndrome as a result of a fracture, information on the development of compartment syndrome from other causes may be beneficial.
- 68% of acute compartment syndrome was diagnosed within the first 24 hours

- The median intracompartmental pressure measures is 55mmHg ranging from 40-100mmHg

- All cases of compartment syndrome were treated with a fasciotomy

- Complications post compartment syndrome was 19%

- There are limited studies that review compartment syndrome in the paediatric population

- This study questions if the rates of compartment syndrome in the paediatric population may be lower, especially under the age of 12, this is out of the scope of this study

- Recommendations for further research because there is limited research on paediatric population in relation to development of compartment syndrome.

- Outcome: compartment syndrome can develop up to 65 hours post injury, early recognition of ACS can lead to positive outcomes and diagnosis is based on clinical symptoms

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| - A database search of CINAHL and Medline was undertaken, a search on compartment syndrome had 2050 results and a search on neurovascular assessment returned 27 results. |
| - Almost all articles indicated that compartment syndrome is a potential complication from trauma or orthopedic surgery. |
| - Pathophysiology of compartment syndrome is outlined |
| - Causes of compartment syndrome are outlined |
| - Early detection of neurovascular deterioration is essential in preventing long term complications. |
| - Acute compartment syndrome can occur up to fifty four hours after injury of surgery. |
| - Pressure in a compartment can be monitored by a compartment pressure monitor, this is an invasive procedure and performed under general anesthetic |
| - Normal compartment pressure is 0-8mmHg, compartment syndrome is generally present above 8mmHg. |
| - No studies have an exact pressure when surgical intervention is necessary, the figures range from 10-45mmHg |
| - Accurate documentation is important. |
| - When deterioration is noticed communication with health care teams is essential |
| - Observations include assessment of pain, warmth, sensation, and movement of the limb. |

- Limitation: There is a high incidence of patients who had trauma from motor bike or skiing accidents, it is questionable that the rates of skiing accidents is high because of the popularity of the sport in Austria.
Neurovascular observations is also known as the 5 P’s: pain, pulse, pallor, paraesthesia, and paralysis. Discusses palpation of the limb as a sign of compartment syndrome. Neurovascular observations in the pediatric population should be carried out hourly and if any immediate concerns more frequently. It is recognized that there is difficulties in assessing patients neurovascular status in the pediatric population. Outcomes: delays in identification of deterioration in neurovascular status can lead to limb amputation. No further recommendations were proposed in the study. Recommendations: No recommendation for further studies was mentioned in this study. The study does outline there is limited literature on pediatric neurovascular assessment.

**Compartment syndrome** is a well documented complication associated with musculoskeletal trauma or.

- Outlines when neurovascular assessment is indicated
- Trauma can result in damage to blood vessels and nerves this can result in temporary or permanent deficit in function.
- Description and definition of acute compartment syndrome
- Patients at risk of compartment syndrome.
- Patients are at risk from 1 to 64 hours
- Staff should recognize the context of neurovascular assessment and should communicate clinical concerns to the appropriate treating team
- Neurovascular assessment involves assessing changes in oxygenation, circulation and nerve function.
- Neurovascular status should be assessed every 1-2 hours for the initial 24 hours after surgery, trauma, or application of a cast.
- It is suggested that acute compartment syndrome is more common in men and young people
- Assessment of neurovascular status includes assessment of the 5P’s: pain, pallor (colour), peripheral pulses, paraesthesia (or sensation), and paralysis (or movement).
- **Pain:** Explains how to undertake assessment
- Pathophysiology of pain from compartment syndrome.

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- This article is a literature review of the current literature related to neurovascular assessment. It outlines the distinct assessment components and highlights the importance of its inclusion in nursing practice. This article introduces a clearly focused aim which is consistent with the conclusion and is a strength in this article.
- However this article does not indicated size it is a lengthy article with an extensive reference list. We can assume it is a large scale literature review. Only assumptions can be made.
- This article has no information about its search strategy or where the articles were gathered from or how many, this is a limitation.
- However this article states it reviewed current literature no time frame is indicated. This is a limitation.
- No specific population group was mentioned in the study.
- Visually monitoring pressure of the limb is mentioned in this article different to most other literature researched.
- No strengths or limitations were mentioned in the study.
- Level VII evidence
- Validated pain assessment should be used consistently
- **Pallor or perfusion:** Explains how to undertake assessment and what deficiencies indicate
  - Capillary refill should be less than 3 seconds, more than 3 seconds could indicate insufficient circulation
- **Pulses:** Explains assessment of pulses and outlines what deficiencies indicate
  - Difficult in non-verbal patients
- **Paraesthesia and paralysis:** Explains how to undertake assessment and outlines what deficiencies indicate
- **Pressure:** Pressure is mentioned as a part of neurovascular assessment
- **Nursing management for compartment syndrome is outlined**

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- Applicators such as plaster, splints and tight bandages that restrict movement can cause damage to nerves and blood vessels which can lead to deficits in functions. This can be temporary or permanent and can deteriorate to the point of needing amputation.
- Compartment syndrome is a complication to neurovascular compromise
- Definition of compartment syndrome
- Neurovascular assessment and what it involves is outlined this includes the 5P’s, pain, paralysis, paresthesia, pulses and pallor. It also includes warmth and swelling into the neurovascular assessment
- Step by step guide to performing neurovascular assessment
- Pain assessment is outlined, including signs and symptoms of compartment syndrome including pain disproportionate to the injury
- Paralysis assessment is outlined, including signs and symptoms of movement deficits and what deterioration indicates
- Paresthesia assessment is outlined including signs and symptoms of deterioration and what that indicates.
- Pulses and capillary refill assessment is explained including signs and symptoms of deterioration, including what the deterioration indicates.
- Pallor and temperature assessment is outlined including signs or deterioration and what it indicates.
- Swelling assessment is outlined
- Information should be documented when conducted, if any decrease in neurovascular status contact medical team
- Elevation of the limb will assist in decreasing swelling

- This article has no method or search strategy however it is evident this article is a literature review.
- However this article does not indicated size it can be assumed it is extensive with a large reference list. We can assume it is a large scale literature review
- The summary is clear and sets a clear focus on the aim of the article. The conclusion sums up the aim of the article well.
- There is no mention of the target population group of this article, this limits generalisability of results.
- Information in this article is consistent with other literature reviews gathered for the purpose of this clinical practice guideline. Especially assessment of the 5P’s.
- Different to other literature reviews it highlights monitoring of swelling as part of a neurovascular assessment
- No strengths or limitations were mentioned in the article
- Level VII evidence
Anything constricting the limb should be loosened to ensure it does not impede circulation