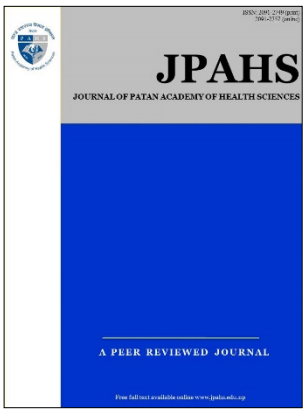

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Knowledge regarding prevention of post traumatic compartment syndrome of limbs among nurses of a teaching hospital

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Abstract

Introduction: Acute compartment syndrome is a serious complication of limb trauma. This is associated with significant morbidity if not diagnosed and treated urgently and effectively on time. Nurses' Knowledge regarding compartment syndrome is one of the important measures for early diagnosis and prevention. This study aims to assess the knowledge regarding the prevention of post-traumatic compartment syndrome of limbs among nurses of a Teaching Hospital.

Method: Descriptive cross-sectional study was conducted to assess the knowledge regarding the prevention of post-traumatic compartment syndrome of limbs at Patan Hospital, Nepal from 12 August to 7 September 2018. Total enumerative sampling technique was used among nurses from surgical, orthopedic, private, and emergency. Data was collected using a structured self-administered questionnaire and analyzed using SPSS version 16.

Result: Out of 90 nurses, 38(42.22%) had an adequate level of knowledge, 29(32.22%) had a moderate level of knowledge and 23(25.56%) had an inadequate level of knowledge regarding the prevention of post-traumatic compartment syndrome of limbs. There was no significant association between age, level of education, working experience, working area, and level of knowledge. Working experience in the orthopedic ward had a significant association with the level of knowledge.

Conclusion: Nearly half of the respondents had an adequate level of knowledge regarding the prevention of post-traumatic compartment syndrome of limbs. Nurses working in the orthopedic ward had a good level of knowledge than working in other words.

Keywords: compartment syndrome, knowledge, nurses, prevention

Introduction

Compartment syndrome (CS) is raised tissue pressure within the closed osteofascial compartment, leading to a lack of tissue perfusion resulting in tissue or organ damage.[1,2] Usually 6 "Ps" are associated with CS, pain, paresthesia, pallor, paralysis, pulselessness, and high intra-compartment Pressure.[3-6]

Initial management involves removing any casts or dressings overlying the limb. However, after removing the cast the patient should be closely examined kept limbs at heart level for perfuse.[3, 4,]

A descriptive study to determine the nurses' knowledge towards cast complications in the orthopedic ward showed that 44% of nurses had a low level of knowledge, 29% had a moderate level of knowledge and 27% had a high level of knowledge[4]. Education is effective in improving nurses' knowledge of neurovascular assessment skills. [7]

Post-traumatic compartment syndrome is a devastating complication if not diagnosed and properly managed. Delay in treatment can result in significant disability including the neurologic deficit, [7, 8, 13, 14].

Nurses are the frontline round the clock care providers. Their knowledge plays a vital role in the early detection and prevention of compartment syndrome. Thus, the study aims to assess the nurses' knowledge regarding the prevention of post-traumatic compartment syndrome of limbs among nurses of Patan Hospital.

Method

A cross-sectional of prospectively collected data at Patan Hospital, Patan Academy of Health Sciences, PAHS, Nepal, from 12 August to 7 September 2018. A self-developed, close the ended questionnaire was used for the study. The interview tool was developed by reviewing literature consulting research advisor and subject teacher by the researcher. The questionnaire consisted of three parts, Part I- socio-demographic variables, part II- knowledge of post-traumatic compartment syndrome of limbs, and part III- knowledge regarding prevention of post-traumatic compartment syndrome of limbs.

Total numbers of nursing staffs in selected wards (orthopaedic, emergency, private and surgical) (N) =94, Marginal error (d) = 5% (0.05). According to Slovin's formula, Sample size (n) = $N/1+Nd^2$ = 76. Including 10% non-response (8), final sample size was taken 84.

According to calculation sample size was 84 but all those who were available during the data collection period were included in the current study hence sample size was 90.

All the levels of nurses working in the orthopaedic ward (17), private ward (25), surgical ward (19), and emergency ward (29) of Paten Hospital were included in the study. A total enumerative sampling technique was used to collect data. The sample size for the study was 90 nurses.

Data collection was done upon approval from research committee of Lalitpur Nursing Campus and Institutional Review Committee (IRC) of PAHS (Ref: pna1807081193 Date 2018-07-08). Permission was obtained from concerned authority of PAHS, Teaching Hospital before data collection.

Those nurses who were on long leave during data collection period were excluded in the study. A written consent was taken. Data were collected by the researcher herself. The time selected for data collection was 10:30 am - 4 pm. Nurses were provided a questionnaire to fill in their free time and asked them to return the filled questionnaire after as they finished within the same day. The time required to complete the questionnaire was 30-40 minutes, 4-6 participants per day. Data were processed using Statistical Package for Social Sciences (SPSS) version 16 and analyzed using descriptive statistics such as frequency,

percentage, mean, standard deviation. The inferential statistics, Chi-square test was used.

Result

There were 90 respondents in the study. The mean age was 27.62±5.33 years. Seventy-one (78.89%) of respondents were in the age group of 20-30 years. Forty-six (51.11%) of respondents had completed their Bachelor in Nursing/ Bachelor of Nursing Sciences (BN/BNS). Ninety (100%) of respondents did not have any training in orthopaedic nursing, Table 1.

Sixty-one (67.77%) of respondents had 1-5 years of work experience. Twenty-nine (32.24%) of respondents were from the emergency department, Table 1.

To measure the knowledge about post-traumatic compartment syndrome of limbs, respondents were asked a series of questions regarding post-traumatic compartment syndrome of limbs, Table 2.

Forty-nine (54.44%) of respondents answered post-traumatic compartment syndrome is raised pressure within the compartment. Forty-six (51.11%) of respondents gave information about the main condition causing compartment syndrome is increasing internal pressure in the muscle.

Seventy-two (80%) of respondents knew that pain is the first sign of compartment syndrome. Sixty-two (68.89%) of respondents answered paralysis is the late sign of compartment syndrome.

Seventy-seven (85.56%) of respondents knew that tight bandage should be loosened to assess compartment syndrome. Sixty-seven (74.44%) replied the need to evaluate motor and neurologic function to assess compartment syndrome, Table 2.

Forty-one (45.56 %) of respondents answered that client should be asked for numbness or tingling sensation when the nurse is unable to assess the capillary refill time. Forty-two (46.67%) respondents believed 6 P's associated with compartment syndrome are pulselessness, pressure, pain, paresthesia, paralysis, pallor, Table 3.

Sixty-seven (74.44%) of respondents answered compartment syndrome can be prevented by keeping the leg horizontal and monitoring neurovascular status. Seventy (77.18%) replied that the nurses need to notify the physician for presence of signs and symptoms. Forty-one (45.56%) of respondents answered that arm should be placed in a sling well supported across the shoulder.

Fifty-eight (64.45 %) of respondents knew that observing the color of the finger in the limb with the plaster cast the early detection of compartment syndrome with a plaster cast that is to observe the color of the fingers.

Thirty-one (34.44%) respondents answered that immediate notification is required if there is an onset of paralysis in the toes of the casted foot, Table 3.

Out of 90 nurses, 38 (42.22%) had an adequate level of knowledge, and 23(25.56%) had an inadequate level of knowledge regarding the prevention of post-traumatic compartment syndrome of limbs, Table 4.

There was no significant association between age and level of knowledge at 95% confidence level (p-value 0.673) , Table 5.

There was no significant association between level of education, working experience, working area, and level of knowledge p-value: 0.473, 0.137, and 0.715, respectively.

But the study reveals that there was a significant association between working experience in orthopaedic nursing and level of knowledge (p-value: 0.015), Table 5.

Table 1. Demographic characteristic of nurses regarding prevention of post traumatic compartment syndrome of limbs, N=90

Variables	N	%
Age Group in years Mean age± SD =27.62± 5.33		
20-30	71	78.89
31-40	17	18.89
41-50	2	2.22
Educational Level		
PCL Nursing	41	45.56
BSc Nursing	3	3.33
BN/BNS	46	51.11
Total work experience in years		
1 to 5	61	67.77
5 to 10	23	25.57
10 to 15	4	4.44
15 to 20	2	2.22
Current working area		
Surgical ward	19	21.11
Orthopaedic ward	17	18.88
Emergency	29	32.24
Private ward	25	27.77

Table 2. Knowledge of Post Traumatic Compartment Syndrome of nurses regarding prevention of post traumatic compartment syndrome of limbs, N=90

Variables ([a] = Multiple Response)	N	%
Introduction of compartment syndrome		
Muscle damage within the compartment	9	10
Raised pressure within the compartment	49	54.44
Neurovascular damage within the compartment	29	32.22
Sensory loss of distal part of injury	3	3.34
Main causes of compartment syndrome		
Increase internal pressure in the muscle	46	51.11
Increase external pressure in the muscle	8	8.89
Increase blood pressure	8	8.89
Increase in both external and internal pressure	28	31.11
The first sign of compartment syndrome		
Pain	72	80
Pallor	10	11.11
Paresthesia	2	2.22
Loss of pulses	6	6.67
A late sign of compartment syndrome		
Pain	1	1.11
Paralysis	62	68.89
Absent Pulse	19	21.11
Swelling	8	8.89
Nursing considerations with compartment syndrome [a]		
Reduce weight in traction	47	52.22
Position the affected limb at heart level	63	70
Split the cast or splint	70	77.78
Loosen the tight bandage	77	85.56
Nursing consideration to assess compartment syndrome		
Measure Temperature	5	5.56
Assess Tenderness	15	16.67
Evaluate motor and neurologic function	67	74.44
Measure Blood pressure	3	3.33

Table 3. Knowledge of nurses regarding prevention of post traumatic compartment syndrome of limbs, N=90

Variables	N	%
Assessment of fractured extremity		
Ask the client if numbness or tingling sensation	41	45.56
Palpate the pulses distal to the injury	25	27.78
Palpate the skin temperature distal to the injury	12	13.33
Assess the skin adjacent to the nail bed	12	13.33
6 P's associated with compartment syndrome		
Pulselessness, pressure, pain, paresthesia, paralysis, pallor	42	46.67
Pain, pallor, paresthesia, partition, popliteal pressure, paralysis	29	32.22
Paresthesia, paresis, partition pain, pallor, palpitation	7	7.78
Pain, pallor, paresis, partition, palpation, paresthesia	12	13.33
Main nursing consideration		
Elevating the limb and monitoring for neurovascular status	9	10
Elevating the limb and covering the limb with blankets	8	8.89
Keeping the leg horizontal and monitoring the neurovascular status	67	74.44
Placing the leg slight abduction position	6	6.6
Nurses' action [a]		
Regular neurovascular assessment should be done.	57	63.33
Isometric exercise of affected limb should be taught	62	68.89
Provide traction care	73	81.11
Notify the physician if any sign and symptom present	70	77.18
Position the client's limb after application of a cast		
The arm should place in a sling well supported	41	45.56
The hand should be placed below the level of the elbow	12	13.33
The upper hand should be placed above the level of the heart	31	34.44
Allow the client to move the hand	6	6.67
Early detection of compartment syndrome		
Observe the color of the fingers	58	64.45
Palpate the radial pulse under the cast	24	26.67
Check the cast for odor and drainage	4	4.44
Evaluate the response to analgesics	4	4.44
Finding require immediate notification		
Complain of moderate pain by the client	10	11.11
Report the heat is being felt under the cast by the client	25	27.78
Presence of slight edema of the toes of the casted foot	24	26.67
The onset of paralysis in the toes of the casted foot	31	34.44

Note: [a] Multiple Response

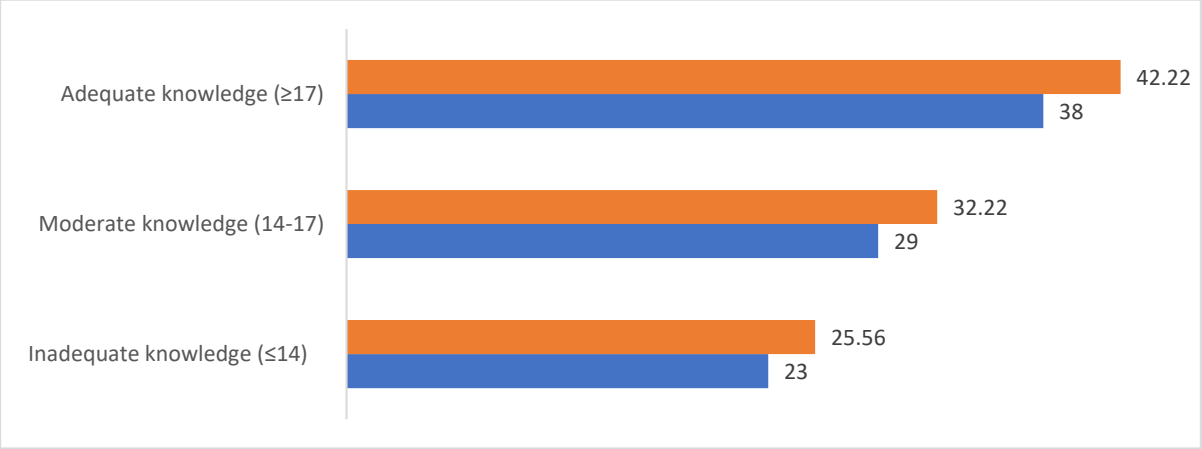

Figure 4. The overall level of knowledge of nurses on prevention of compartment syndrome, N=90

Table 5. Association between selected socio-demographic characteristics and overall level of knowledge of nurses (N=90) regarding prevention of post-traumatic compartment syndrome

Characteristics	Level of knowledge			
	Inadequate Number(%)	Average to adequate Number(%)	χ2	p-value
Age (years)				
< 35	22(26.3%)	61(73.7%)	0.507	0.673**
≥36	1(14.3%)	6(85.7%)		
Level of Education				
PCL Nursing	9(22.0%)	32(78.0%)	0.514	0.473
BNS/PBBN/BSC	14(28.6%)	35(71.4%)		
Work experiences				
Below 10 years	23(27.4%)	61(72.6%)	2.207	0.137**
11 years and above	0(0.0%)	6(100.0)		
Working area				
Emergency and Orthopaedic	11(23.9%)	35(76.1%)	0.133	0.715
Private and Surgical	12(27.3%)	32(72.7%)		
Experience in Orthopaedic Ward				
Yes	4(11.4%)	31(88.6%)	6.008	0.015*
No	19(34.5%)	36(65.5%)		

*Chi square test: Significant at p< 0.05 & 95% confidence level, ** Fisher Exact Test where P value less than 0.05 (2 Tailed)

Discussion

The finding of the present study showed that regarding the definition of post-traumatic compartment syndrome of the limbs only half of the nurses (54.44%) replied correctly about raised pressure within the compartment. In contrast, other studies report higher (79%) correct responses.[4,8] The poor level of knowledge could be due to a lack of any in-service education or training for nurses.

The current study reveals that most of the respondents (80%) replied pain is the first sign of compartment syndrome but a study conducted in India showed that 42% of respondents replied pain is the first sign of compartment syndrome.[4, 9] This could be due to experience and nursing education.

The finding of the current study showed that 25.56% of respondents had an inadequate level of knowledge, 32.22% of respondents had a moderate level of knowledge and 42.22% had an adequate level of knowledge on the overall level of knowledge regarding prevention of traumatic compartment syndrome of the limbs. However, another study reveals that 44% had a low level of knowledge, 29% had moderate level of knowledge and 27% had a high level of knowledge.[3] This could be due to nurses working in Patan hospital are not getting any in-service education and training.

The current study showed that regarding knowledge on post-traumatic compartment syndrome of limbs, 43.33% of respondents had an adequate level of knowledge, 33.33% had an inadequate level of knowledge and 23.33% had a moderate level of knowledge.[1]

The current study found that there is no association between age, level of education, work experience, and working area, and overall level of knowledge. Similar finding that showed that there was no association with years' experience and age found in another study. The finding of the study showed that there was an association between experience in the orthopaedic ward and overall level of knowledge.

The possible implication of the outcomes of the present study might be beneficial to the nursing department of PAHS, Teaching Hospital to develop education programs like training and continuous professional development education for nurses. The study would provide educational background and literature to other studies which might act as a reference to another researcher in the future.

The possible limitation of the study includes that content validity of the instrument was not done due to the time constraint; the study was limited to nurses of PAHS Teaching Hospital. Therefore, the finding of the study could not be generalized in another setting. The sample selection technique was an enumerative sample that lacks randomization. Hence it limits the generalization of the findings of the study. Non –probability, convenience sampling was used for sample selection, so the sample bias might occur.

Conclusion

This study revealed that nearly half of the respondents had an adequate level of knowledge regarding the prevention of post-traumatic compartment syndrome of limbs. Nurses working in the orthopaedic ward scored better than other wards. A significant association was found between experience in orthopaedic nursing and the level of knowledge regarding the prevention of post-traumatic limb compartment syndrome.

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Conflict of Interest

None

Funding

None

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Supplement

Questionnaire

Self - administered a questionnaire on Knowledge regarding traumatic limb compartment syndrome and its prevention among nurses in Patan Hospital.

Instructions: Respondents are kindly requested to tick mark on the appropriate responses, some questions have multiple responses, and fill up their answers in the spaces provided. The obtained data will be kept confidential.

Code No….. **Date…..**

Part I: Questions related to socio-demographic variables

1. Age (In completed Year) ……
2. Level of education
   a. PCL nursing
   b. BSc Nursing
   c. BN/ BNS
3. Do you have experience in the orthopedic ward?
   a. Yes, If yes how many years……
   b. No
4. Did you get any special training in orthopedic nursing?
   a. Yes
   b. No
5. Total Work experience in the current ward. ……
6. Which is your current working ward in Patan Hospital? ……

Part II: Questions related to knowledge of post-traumatic compartment syndrome of limbs.

1. What is traumatic limb compartment syndrome?
   a. Muscle damage within the compartment
   b. Raised pressure within the compartment
   c. Neurovascular damage within the compartment
   d. Sensory loss of distal part of injury

2. Compartment syndrome is commonly seen on
   a. Tibial fractures
   b. Elbow/forearm fracture
   c. Femur fracture
   d. Proximal humerus fractures

3. Which of the following compartment is the most common site for compartment syndrome of legs?
   a. Anterior compartment
   b. Posterior compartment
   c. Deep posterior compartment
   d. Superficial posterior compartment

4. Which of the following are the possible sites for developing compartment syndrome?
   a. Face, hands, fingers
   b. Lower leg, forearm, wrist, and hand
   c. Head, face, neck
   d. Neck, buttock, Lower legs

5. Which one of the following is the main condition that causes compartment syndrome?
   a. Increase internal pressure in muscles
   b. Increase external pressure in muscles
   c. Increased blood pressure
   d. Increase in both external and internal pressure in muscles

6. Which of the following characteristics of the fascia can cause it to develop compartment syndrome?
   a. It is highly flexible
   b. It is fragile and weak
   c. It is unable to expand or stretch
   d. It is only the tissue within the compartment

7. What should you recommend for a patient who has compartment syndrome?
   a. Reduce weight in traction
   b. Position the affected limb at heart level
   c. Split the cast or splint
   d. Loosen the tight bandage

8. What is the first sign of compartment syndrome?
   a. Pain
   b. Pallor
   c. Paraesthesia
   d. Loss of pulses

9. Which of the following is a late sign of compartment syndrome?
   a. Pain
   b. Paraesthesia
   c. Absent pulse
   d. Swelling

10. In compartment syndrome, with comprised blood supply creating ischemia, irreversible muscle damage occurs within…….
    a. 1-3 Hours
    b. 4-6 hours
    c. 7-10 hours
    d. 11-14 hours

11. Which of the following nursing consideration is used to assess the compartment syndrome
    a. Manometer
    b. Assess tenderness
    c. Evaluate motor and neurologic function
    d. Measure blood pressure

12. Which of the following is the diagnostic criterion of the compartment syndrome?
    a. Clinical signs and symptoms
    b. Measurement of bone mass density
    c. Electromyography
    d. Bone biopsy

13. One of the common complications of compartment syndrome is
    a. Volkmann's contracture
    b. Heart failure
    c. Osteoarthritis
    d. Bone Tuberculosis

14. A surgical procedure done to relieve pressure in compartment syndrome is
    a. Open reduction internal fixation
    b. Meniscectomy
    c. Fasciotomy
    d. Arthroplasty

Part III: Questions related to knowledge regarding the prevention of post-traumatic compartment syndrome of limbs

1. When assessing the client's fractured extremity, if the nurse is unable to assess the capillary refill in the beds what should the nurse do?
    a. Ask the client if numbness or tingling sensation is present.
    b. Palpate the pulses distal to the injury
    c. Palpate the skin temperature distal to the injury
    d. Assess the skin adjacent to the nail bed

2. Which of the following 6 P's are associated with compartment syndrome?
    a. Pulselessness, pressure, pain, paraesthesia, paralysis, pallor
    b. Pain, pallor, paraesthesia, partition, popliteal pressure, paralysis
    c. Paraesthesia, paresis, partition, pain, pallor, palpitation
    d. Pain, pallor, paresis, partition, palpation, paraesthesia

3. Which of the following is the main nursing consideration to prevent the development of compartment syndrome?
    a. Elevating the limb and monitoring for neurovascular status.
    b. Elevating the limb and covering the limb with blankets
    c. Keeping the leg horizontal and monitoring neurovascular status.
    d. Placing the leg slight abduction position

4. If the patient is on skin traction, what nursing action should be to prevent compartment syndrome. (multiple responses)
    a. Regular neurovascular assessment should be done.
    b. Isometric exercise of affected limb should be taught
    c. Traction care should be provided.
    d. Notify the physician if any sign and symptoms of compartment syndrome are present

5. After application of cast in upper extremities, how should the nurse position the client's limb for the first 24 hours to prevent compartment syndrome?
    a. The arm should be placed in a sling well supported across the shoulders.
    b. The hand should be placed below the level of the elbow
    c. The upper hand should be placed above the level of the heart
    d. Allow the client to move the hand from a high position to allow position according to comfort.

6. A client who has had a plaster of Paris cast applied to his forearm is receiving pain medication. To detect early manifestations of compartment syndrome, which of the reassessments should the nurse make?
   a. Observe the color of the fingers
   b. Palpate the radial pulse under the cast
   c. Check the cast for odor and drainage
   d. Evaluate the response to analgesics

7. While caring for a client with a newly applied plaster of Paris cast, the nurse makes note of all the following conditions. Which assessment finding requires immediate notification of the physician?
   a. Complain of moderate pain by the client
   b. Report the heat is being felt under the cast by the client
   c. Presence of slight edema of the toes of the casted foot
   d. The onset of paralysis in the toes of the casted foot

8. Which one of the following is the is the method of assessing for the sign of circulatory impairment in a client with a fractured femur is to ask the client to?
   a. Measure blood pressure
   b. Turn patient in bed
   c. Perform biceps exercise
   d. Wiggle his toes