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A Decade of Critical Care Medicine in Nepal

Subhash P Acharya

Department of Critical Care, Maharajgunj Medical Campus, IOM, TUTH, Maharajgunj, Kathmandu, Nepal.

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Introduction

The first ICU in Nepal started in 1973 at Bir Hospital as a five 5 bed medical ICU which was started after King Mahendra Bir Bikram Shahdev suered some heart problem in 1970 and returned from his treatment in Delhi when he felt the need of ICU. [1,2] Ms. Rameshwori Shrestha, was known as the First ICU Nurse who worked in this ICU at Bir Hospital.[3]

In Nepal, Anesthesiologists were and still are the main physicians working in ICU along with other specialist as Society of Anesthesiologist of Nepal (SAN) was established since November 1987 and have been working in developing anesthesia, critical care and pain medicine services and education in the country.[4]

Nepalese society of Critical Care Medicine (NSCCM) was established on 10 April 2010 and became a member of WFSICCM in 2018 and currently there are 160+ Life members. NSCCM has been organizing CME every month and organized its first conference in 2014 and since then in 2016, 2018 and in 2022 organized twenty second Asia Pacific Association of CCM (APACCM) Conferences in Nepal which was one of the major events. NSCCM is involved in various academic activities, workshops, CMEs for strengthening ICU services in Nepal.[5,6]

Nepal Critical Care Development Foundation (NCCDF) was established in 2012 as not for profit, charitable NGO. NCCDF organizes short courses trainings and workshops focusing in critical care in collaboration to CCNAN and NSCCM and also organizes various awareness programs on Sepsis Day and Hand Hygiene Day.[7]

Critical Care Nurses Association of Nepal (CCNAN) was established in 2016 and presently has 200+ life members. CCNAN is involved in developing Instructors for Critical Care Nurse Training Program (CCNTP) which certifies nurses as Critical Care Nurses. CCNAN also organized the First International CCN Conference in Kathmandu in November 2017 and also established the Regional Federation CCN – SAARC (RFCCN-SAARC). India became the first president of RFCCN SAARC and organized a conference in Belgaum, Bengaluru in 2018 and again in 2019, Second Conference of RFCCN-SAARC was organized in Butwal, Nepal and the presidency of RFCCN-SAARC was handed over to Nepal.[8]

Considering academic programs, the first Doctorate of Medicine in Critical Care Medicine (DM CCM) was started at Institute of Medicine, Tribhuvan University from 2013 with support from Royal College of Canada International (RCCI, RCPSC). National Board of Medical Specialties (NBMS) from Medical Education Commission(MEC) has also started a three-year National Board Fellowship in CCM since 2021. Also, there has been a one-year clinical fellowship in CCM running in National Academy of Medical Sciences (NAMS) from 2020 and NSCCM has currently established a National Institute of Critical Care Medicine (NICCM) which had started a oneyear fellowship in adult critical care in three different hospitals of Nepal.[6] Considering Critical Care Nursing, Masters in Critical Care Nursing has been started from 2023 at Maharajgunj Nursing Campus, Institute of Medicine, Tribhuvan University

Correspondence:
Subhash P Acharya, Department of Critical Care Medicine, Maharajgunj Medical Campus, IOM, TUTH, Maharajgunj, Kathmandu, Nepal.
Email: drsuvash@gmail.com

which is a two-year academic program to develop academic leadership in CCN.[9]

Nepal Intensive Care Research Foundation (NICRF) was established in 2020 and focused on research and then started ICU Registry which is now running across 19 ICUs in the country and conducting multinational trials.

As per a study in 2020, there were total 194 Hospitals with ICUs and total 1595 ICU beds in the country and 840 ICU Beds with ventilators. However, as of now, there only around 35 Intensivists in Nepal and only 2.8 ICU Beds/100,000 population.

As COVID has brought in huge investment in infrastructure and equipment but the parallel growth trained human resources is far from reality and thus there are gaps in implementation of standard of care. The current need of Critical Care in Nepal is trained human resources, more resources in clinical research, patient safety and quality.

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Original Article

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Comparative study on Postoperative Analgesia with Transversus Abdominis Plane block to Local Anesthetic Infiltration with Ropivacaine in Laparoscopic Cholecystectomy

Surendra Bhusal[1], Brihaspati KC[2], Kaushal Tamang[3], Gaurav Ratna Bajracharya[1], Pratigyan Gautam[4]

[1] Department of Anesthesiologist and Intensive Care, Bir Hospital, National Academy of Medical Sciences, Mahabouddha, Kathmandu, Nepal.
[2] Department of Anesthesiologist, Registrar in critical care, Norvic International Hospital, Kathmandu, Nepal.
[3] Sukraraj Tropical and Infectious Disease Hospital, Teku, Kathmandu, Nepal.
[4] Department of Obstetrics and Gynecology, Kathmandu Medical college, Kathmandu, Nepal.

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Abstract

Introduction: Pain is distressing and detrimental in post-operative patients. We compared post operative analgesia provided by the ultrasound guided transversus abdominis plane block to the local anesthetic infiltration of ropivacaine in patients who underwent laparoscopic cholecystectomy.

Methodology: We conducted comparative, interventional study among 100 patients. The patients were randomly assigned into two groups having 50 in each group. The TAP block group received 20 ml of 0.2% Ropivacaine each on bilateral transversus abdominis plane with ultrasound guidance at the end of surgery. For Local infiltration group (n=50), 20 ml of 0.2% ropivacaine was deposited intraperitoneally in the gall bladder bed and under the right crus of diaphragm before abdominal de-sufflation. Local infiltration group also received infiltration with ropivacaine (0.2%) 20 ml total on three port sites. Visual analog scale at rest and movement measured at 2, 4, 8, 12 and 24 hours after intervention was our primary outcome. Secondary outcome measures were duration of analgesia, total pethidine consumption and ketorolac consumption for the first 24 hours postoperative period.

Result: Visual analogue pain score at rest at 2, 4 and 8 hours and on movement at 2 hours and 4 hours was significantly lower in TAP block group compared to Local infiltration group. TAP block group had significant difference in duration of analgesia compared to Local infiltration group (361 vs 153 min, $p < 0.05$). TAP block group also had significantly lower consumption of pethidine and ketorolac during the first 12 hours compared to Local infiltration group ($p < 0.05$).

Conclusion: Transversus abdominis block had lower pain score, increased duration of postoperative analgesia and reduced requirement of rescue drugs in the post operative period compared to combined port site and intraperitoneal local infiltration.

Correspondence:
Surendra Bhusal, Department of Anesthesiologist and Intensive Care, Bir Hospital, National Academy of Medical Sciences, Mahabouddha, Kathmandu.
Email: surendrabhusal@gmail.com

Introduction

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage.[1] Pain treatment increases speed of recovery, decreases length of stay, reduces hospital costs, increases patient satisfaction, increases productivity and quality of life.[2]

Intravenous opioids have been used for decades for post operative analgesia. Side effects of opioids administration include nausea, vomiting, respiratory depression, constipation, tolerance, sedation, dizziness, physical dependence, and addiction.[3] Administration of local anesthetic in central neuraxial space is an attractive alternative for management of postoperative pain to spare use of opioids. But there are several complications associated with neuraxial blockade which include exaggerated physiological responses leading to hypotension, bradycardia, high neural blockade, urinary retention, and cardiac arrest.[4] Peripheral nerve blockade or field block with local anesthesia is helpful in managing postoperative pain effectively whilst avoiding complication associated with intravenous narcotics or neuraxial blockade.[5]

The Transversus Abdominis Plane (TAP) block is used to anesthetize and provide analgesia to the abdominal wall. The potential space between the two abdominal muscles contains the anterior rami of the lower six thoracic nerves (T7 to T12) and first lumbar nerve (L1) which supply the abdominal muscles and skin. The thoracic nerve T7 to T9 supply the skin above the umbilicus while the thoracic nerve T10 supply the umbilicus. The thoracic nerve T11, T12, ilioinguinal nerve (L1) and iliohypogastric nerve (L1) supply the skin below the umbilicus.[6] Transversus abdominis plane block covers the nerve originating from anterior rami of the lower six thoracic nerves (T7 to T12) and first lumbar nerve (L1).[7] TAP block was first introduced in 2001. Single dose local anesthetic was injected into the plane between the internal oblique and transversus abdominis muscle.[8] The use of ultrasound for TAP block has increased success rate with reduction in complication rates. Over 60% of ambulatory patients undergoing abdominal laparoscopic surgery experience moderate to severe postoperative pain.[9] The aim of this study was to compare the analgesic efficacy of ultrasound-guided TAP block using ropivacaine with local infiltration using ropivacaine at port site and gall bladder bed in patients undergoing laparoscopic cholecystectomy.

Methodology

The ethical approval for the study was taken from the institutional review board of National Academy of Medical Sciences (IRB No. 877-076077). Patients with ASA physical status I or II of either sex aged 25-70 years and posted for elective laparoscopic cholecystectomy were included in the study. Patients with any absolute contraindications to peripheral nerve blockade, uncontrolled diabetes mellitus, hepatic failure, renal insufficiency, neuropathy, myopathy, or psychiatric disease were excluded from the study. Pregnant patients and patients receiving psychiatric drugs were also excluded. We took 100 small similar sized identical papers. Fifty of the papers were labeled as 'TAP block' and the rest were labeled as 'Local infiltration'. Papers were folded with labels inside and kept in a sealed envelope. In the preoperative visit on the evening before surgery, Visual analogue scale (VAS) consisting of 10 cm line with 0 = no pain and 10 = worst possible pain was explained to the patient.

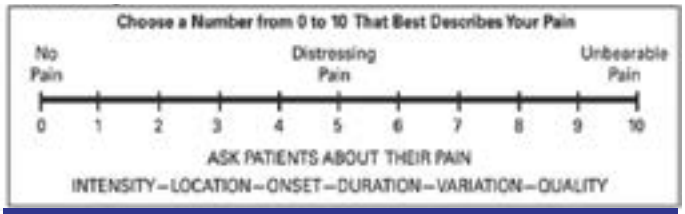

Fig 1: Visual Analogue Scale

All patients received general anesthesia with inj. midazolam 0.03 mg/kg, inj. fentanyl 2 mcg/kg, Inj. propofol 2.5 mg/kg and inj. vecuronium 0.1 mg/kg. Endotracheal intubation was done with appropriate sized endotracheal tube and anesthesia was maintained with isoflurane 1.5%. Any signs of spontaneous breathing or muscle movement intraoperatively were treated with inj. vecuronium 1mg as required. If the surgery extended beyond one and half hours, fentanyl 25 mcg was given every half hour. After completion of surgery, muscle relaxation was reversed with inj. Neostigmine 0.5 mg/kg and inj. glycopyrrolate 0.01 mg/kg. Consecutive patient sampling was done, and eligible patients were randomly allocated to two groups. An anesthesia assistant withdrew one paper from sealed opaque envelope and the allocation of the patient to either the TAP block group or Local infiltration group was done according to label on the paper. At the end of surgery for TAP block group (n=50), sterile painting with 10% betadine solution and draping of the lateral abdominal wall was done on both sides. High frequency ultrasound probe was covered with sterile cover. Then using sterile ultrasound gel, an ultrasound probe was placed transverse to the abdominal wall between the costal margin and iliac crest. We identified the layers of external oblique, internal oblique and transversus abdominis muscle along with the peritoneum and bowel loops which lie underneath the muscles. Then using in plane technique, the 18G, Tuohy needle was advanced through the tissue structures until the tip of the needle was between the plane formed by internal oblique and transversus abdominis muscle. Upon reaching the plane, 3 ml of normal saline was injected to confirm the correct needle position after which injection Ropivacaine (0.20 %) 20 ml on each side was administered. The ultrasound image showing enlargement of hypoechoic space in transversus abdominis plane on injection of ropivacaine confirmed the correct instillment of a drug in the right space. For Local infiltration group, 20 ml of 0.2% ropivacaine was deposited intraperitoneally in the gall bladder bed and under the right crus of diaphragm before

abdominal de sufflation. Local infiltration Group (n=50) also received infiltration with ropivacaine (0.20%) 20 ml total on three port sites. In both groups, pain was assessed with VAS and recorded at 2, 4, 8, 12 and 24 hours after completion of surgery. Duration of analgesia was defined as the time interval between the end of TAP block or local infiltration and the time of first complaint of pain by the patient. At any point of time if VAS was >3, injection pethidine 0.5 mg/kg and injection promethazine 0.25 mg/kg was given via intravenous route. If pain persisted for more than 15 min after giving intravenous pethidine, injection ketorolac 30 mg intravenous was given.

Sample size: Suseela I et al used the numerical rating scale (NRS) consisting of 10 points similar to Visual analogue scale.[13] She compared Transversus abdominis block with local site port infiltration in patients undergoing lap cholecystectomy. The pooled standard deviation (σ) for NRS at two hours was 0.4118. We hypothesized that the minimum difference between the two groups would be 0.25 (d=0.25). We took a confidence level of 95% and power of 80%. Then using the formula $n = (Z_{\alpha/2}+Z_{\beta})^2 * 2*\sigma^2 / d^2$, we calculated the sample size of 43 in each group. Considering the possible 10% dropout, we required 50 patients in each group.

Statistical analysis: Continuous variables were expressed as mean ± standard deviation while categorical variables were expressed as frequency and percentage. Continuous variables were compared between the two groups using independent sample student t test while chi square test was used to compare the categorical variables. When more than 20% of the contingency cell contained expected frequency less than 5, fisher's exact test was used for categorical variable. P value < 0.05 was taken as statistically significant. All the analysis was done with SPSS version 25.

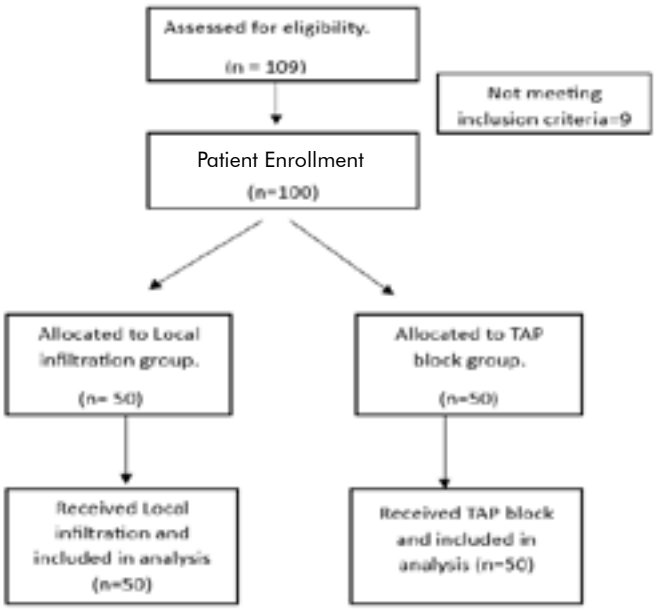

Fig 2: Flow chart of a study.

Results

There was no significant difference in the distribution of age, sex, weight, and ASA grade between the two groups.

Table 1: Demographic data of the patient

Variables	TAP block group (n=50)	Local infiltration group (n= 50)	P value
Age (years) mean +/-SD	38.5 ±5.6	41.2 ± 7.2	0.08
Sex Male/Female	33/17	29/21	0.40
Weight (kg) mean +/- SD	58.3 ±9.7	54 ±10.6	0.07
ASA I/II	39/11	35/15	0.36

ASA: American society of anesthesiologist classification.

We observed that 6 (12%) out of 50 patients in the TAP block group required rescue analgesia in the first 6 hours while 42 (84%) out of 50 patient required rescue analgesia in the Local infiltration group which was significantly different between the two groups (p < 0.001). VAS at rest was significantly lower in the TAP block compared to Local infiltration group at 2 hours, 4 hours and 8 hours. There was no significant difference in VAS at rest after 8 hours between the two groups. VAS on movement was significantly lower in the TAP block group at 2 hours and 4 hours. There was no significant difference in VAS on movement between the two groups after 4 hours.

Table 2: Visual analog scale at rest

VAS (Hour)	TAP block Group (mean± SD)	Local infiltration group (mean ± SD)	P value
2	0.08 ±0.01	1.09 ±1.19	<0.001
4	0.45 ±0.87	3.91 ±2.36	<0.001
8	3.34 ± 2.69	4.34 ±2.67	0.02
12	3.72 ±2.74	3.98 ±3.10	0.13
24	2.45 ±1.96	2.28 ±2.1	0.18

VAS: Visual analog scale

Table 3: Visual analog scale on movement

VAS (Hour)	TAP block group (mean ± SD)	Local infiltration group (mean ± SD)	P value
2	0.08 ±0.02	1.21 ±1.03	<0.001
4	0.78 ±0.90	3.97±2.73	<0.001
8	4.56±2.90	4.66±2.41	0.43
12	5±1.34	4.22±2.07	0.06
24	2.60±1.84	2.09±2.05	0.12

VAS: Visual analog scale

Time to first rescue analgesia was 361±72 min in TAP block

group and 153 ±21 min in Local infiltration group which was statistically significant (p< 0.001). There was a significant difference in pethidine and ketorolac consumption between the two groups during the first 12 hours of postoperative period. The TAP block group had significantly lower pethidine and ketorolac consumption. However, there was no significant difference in pethidine and ketorolac consumption between the two groups after 12 hours. The total pethidine and ketorolac consumption over 24 hours was also significantly lower in the TAP block group.

Table 4: Total pethidine consumption in milligram (mg)

Time Interval (Hour)	TAP block group (Mean)	Local infiltration group II (Mean)	P value
0-6	4.80	12.45	<0.001
6-12	11.12	13.06	0.007
12-24	13.05	12.95	0.23
Total in 24 hours	28.97	38.12	<0.001

Table 5: Total ketorolac consumption in milligram (mg)

Time Interval (Hour)	TAP block-Goup(Mean)	Local infiltration group II (Mean)	P value
0-6	2.20	6.60	<0.001
6-12	6.25	15.00	<0.001
12-24	16.50	16.00	0.53
Total in 24 hours	24.95	37.60	<0.001

Discussion

Postoperative pain management is very important for good surgical outcome of the patient. Inadequate pain management in the postoperative period causes sympathetic hyperactivity leading to tachycardia, hypertension, hyperglycemia.[2] Hence cardiac ischemia and heart failure may be aggravated. Hyperglycemia leads to delayed wound healing.[2] Local anesthesia infiltration at the incision site at the end of surgery is an effective way to prevent pain in the post operative period. But it is very difficult to inject the local anesthetic drugs uniformly between the muscle's layers, soft tissue and over length of incision. Such improper drug distribution in the tissue plane may lead to inadequate pain relief in the post operative period. The deposition of local anesthetics under the right diaphragm in the gall bladder bed has also been shown to reduce the severity of post operative pain and pain on deep inspiration. Such deposition was associated with significantly reduced shoulder pain.[10]

Bilateral Transversus abdominis plane block with local anesthetic drugs has emerged as an excellent way of preventing postoperative pain in a patient with abdominal surgery. The pain relief provided with TAP block also has a prolonged duration compared to other modalities of pain management.[11] Arora et al found that VAS at rest was lower in TAP group than control group in post anesthesia care unit at 0, 2, 6 hours similar to our study.[12] But in a study by Arora et al, VAS was also lower at 24 hours in the TAP group compared to our study.[12] We used 0.2% ropivacaine while Arora et al used 0.5% ropivacaine. The difference in concentration of ropivacaine may have shown prolonged effect in a study by Arora et al. Suseela et al found that time to first analgesic in group transversus abdominis plane (TAP) block and group port site infiltration was 510.3 ± 154.55 min (mean ± SD) and 292.7 ± 67.03 min (mean ± SD) respectively.[13] She observed prolonged duration of analgesia in both TAP and local infiltration group compared to our study. Suseela et al used numerical rating scale (NRS) more than 4 as a cutoff point to determine administration of first rescue analgesia while we used VAS > 3 as an indication to administer rescue analgesic. The different pain measurement tools with different cut off points may have resulted in the differences.
Milone et al found that there was significantly lower requirement of rescue analgesia in the TAP group compared to local infiltration group (14% vs. 32 %, p = 0.01) in the first 6 hours.[14] The requirement of rescue drug in TAP group was like our study. But the requirement of rescue analgesia was significantly higher in local infiltration group in our study compared to their study. We had laparoscopic cholecystectomy cases while their group constituted of patients undergoing inguinal hernia repair only. Such dissimilarity between the surgical cases may explain the higher requirement of rescue analgesic in our study.

Conclusion

Transversus abdominis block was found to provide better pain management, pain relief for prolonged period and lower requirement of rescue drugs in the post operative period compared to combined liver bed and port site local infiltration.

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Original Article

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Hemodynamic Response During Laryngoscopy and Endotracheal Intubation With or Without Low Dose Dexmedetomidine Premedication : An Observational Study

Prashant Silwal[1], Nabin Pokharel[2]

[1] Anaesthesiologist Sindhuli Hospital, Sindhuli, Nepal.
[2] Department of Anesthesiologist and Intensive Care, National Academy of Medical Sciences, National Trauma Center, Mahabuddha, Kathmandu, Nepal.

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Abstract

Introduction: Laryngoscopy and endotracheal intubation are important airway securing techniques for patients undergoing general anaesthesia in operating room. This procedure is associated with significant hemodynamic changes putting undue stress in the heart and the brain circulation . Multiple drug therapies have been used to attenuate these responses, but none have been entirely successful till date. Hence aim of the study is to evaluate effects of single, low dose dexmedetomidine premedication on hemodynamic stress response during laryngoscopy and endotracheal intubation in patient posted for elective surgeries under general anaesthesia requiring endotracheal intubation.

Methodology: A prospective, observational study conducted in Bir Hospital and National Trauma Center after approval from Institutional Review Board with enrollment of 52 patients of American Society of Anesthesiologists Physical Status I and II divided into two equal groups. Dexmedetomidine group received 0.5 microgram per kilogram premedication infusion over 10 minutes. Haemodynamic parameters (heart rate and blood pressures) at baseline, after induction, just before intubation, 1, 3, 5 and 10 minutes after intubation were recorded. The general anaesthesia technique was standarized for both groups. p-value < 0.05 was considered statistically significant.

Results: Demographic data were comparable. Statistically significant decrease ($p < 0.05$) in heart rate, systolic, diastolic, and mean arterial pressures in dexmedetomidine group. None of the patients in dexmedetomidine group had hypotension, bradycardia hypertension and tachycardia.

Conclusion: Dexmedetomidine premedication with 0.5 μg/kg is better for attenuating stress response due to laryngoscopy and endotracheal intubation.

Introduction

In modern era of anaesthesia laryngoscopy and endotracheal intubation (LETI) has been important airway securing technique for patient undergoing general anaesthesia (GA) in operating room. As an anaethesiologist, securing the patient airway is not only ultimate task, rather being vigilant about patient overall status, including hemodynamic stability, throughout the procedure is necessary.

LETI has been associated with 40 to 50% average increase in blood pressure (BP) and 20% increase in heart rate (HR), which are greatest one minute (min) after LETI and last for

Correspondence:
Prashant Silwal, Anaesthesiologist Sindhuli Hospital, Sindhuli, Nepal.
Email: prasantusmle2023@gmail.com

about 5 to 10 min.[1,2] Such significant hemodynamic changes can put undue stress in multiple vital organs circulation. Despite stable hemodynamics, 45% of studied patients had relative coronary artery hypoperfusion immediately after intubation.[3] About half the patient with coronary artery disease experience episodes of myocardial ischemia during intubation when no specific prevention is undertaken.[1, 4, 5]

Risk of arrhythmias, myocardial ischemia associated with LETI can be significantly reduced by administration of prophylactic pharmacological agent.[6] Multiple drugs like lidocaine, thiopental, propofol, fentanyl, clonidine, dexmedetomidine, sodium nitroprusside, nitroglycerine, nifedipine, labetalol and esmolol have been used, but no drug has been significantly superior till the date.[6, 7] Dexmedetomidine is a highly selective alpha2(α2) adrenoreceptor agonist with sedative, anxiolytic, sympatholytic and analgesic effects.[8] Existing comparative studies advocated higher loading dose (1 microgram per kilogram (μg/kg)) of dexmedetomidine to be more effective compared to other drugs.[9,10] Whereas studies with high dose of dexmedetomidine not only seem to attenuate the pressor responses but also associated with increased incidence of adverse effects like hypotension, hypertension, bradycardia and tachycardia.[9, 11, 12]

There is paucity of research on use of low dose dexmedetomidine for blunting. Hence, aim of our study is to observe the effect of single, low IV premedication dose (0.5μg/kg) of dexmedetomidine on hemodynamic stress response during LETI.

Methodology

After ethical approval from institutional review board (IRB) of NAMS, on 2078/1/23 (May 6, 2021), prospective, observational study was conducted from September to December 2021 in, Bir Hospital and National Trauma Centre, Kathmandu, Nepal. Total of 52 patients with American Society of Anaesthesiologists Physical Status (ASA-PS) I & II, between 18-60 years of age of both sexes, scheduled for elective surgery under general anaesthesia requiring laryngoscopy and endotracheal intubation were enrolled after written informed consent. Patients undergoing emergency surgeries, with anticipated difficult airway and multiple intubation attempts (2 or more) or intubation attempt > 15 seconds, Body Mass Index (BMI) > 30 kg/metre^2, pregnant and lactating, having beta blockers, calcium channel blockers, sympatholytic drugs, pregabalin, clonidine or alpha methyl dopa, any known allergies or contraindication of dexmedetomidine, baseline systolic blood pressure (SBP) less than 90 mmHg and diastolic blood pressure (DBP) less than 50 mmHg, baseline HR less than 60 beats/minute were excluded.

Prior published study done by Sarkar et al.[13] where HR at 10 minutes after the intubation was statistically significant between placebo and dexmedetomidine group. Taking this into consideration, sample size of 26 patients in each group has been calculated with 90% power and p-value of 0.05 and assuming 10 % drop-out rate. Patients were allocated into either group ND (non-dexmedetomidine group, N=26) or group D (dexmedetomidine group, N=26).

Detailed pre-anaesthetic evaluation with thorough history, clinical examination and required investigations of all the patients meeting inclusion criteria were done a day before the surgery. The vitals taken during pre-anaesthetic check-up were regarded as baseline vitals (HR, SBP, DBP and mean arterial pressure (MAP)). Patients were nil per oral for at least 8 hours prior to surgery and no pre-medications given. In operating room, intravenous (IV) access was opened by 18-gauge cannula and non-invasive blood pressure monitoring (NIBP), oxygen saturation (SpO2) and electrocardiography (ECG), HR were monitored. Patients in group D, at the dose of 0.5μg/kg total body weight of patient, infusion of dexmedetomidine was done over a period of 10 min via syringe pump. The study drug was prepared in 20 ml syringe with 0.9% normal saline by adding 0.5mcg/kg of dexmedetomidine. General anesthesia technique was standardized for both groups. 5 min after completion of infusion, preoxygenation with oxygen at 8L/min was given via anaesthetic face mask and induction was started with IV fentanyl 2μg/kg (total body weight), IV midazolam 2mg and IV propofol 1% in incremental dose until loss of eyelash reflex was attained. HR, SBP, DBP and MAP were recorded after induction. Isoflurane at 2% was turned on to deepen the depth of anaesthesia. Neuromuscular blockade was achieved with IV rocuronium at 1mg/kg (total body weight). After 3 minutes, with appropriate size laryngoscope (Macintosh laryngoscope) and endotracheal tube, laryngoscopy and tracheal intubation was done. All intubations were done by 2nd year anesthesia resident. The duration of LETI was recorded by author of study. ET tube was inflated, fixed, and secured with the adhesive tape after confirming bilateral equal air entry in lungs by auscultation and connected to mechanical ventilation. HR, SBP, DBP and MAP were recorded just before intubation (during laryngoscopy) and after intubation at 1-min (T1), 3-min (T3), 5-min (T5), 10 min (T10). Only 10 minutes after the intubation, surgeon was allowed for the operative procedure. Further operative and anaesthetic procedure were continued as per planned.

Hypotension was defined as decrease in SBP > 20% of the baseline value or SBP < 90 mm Hg. Hypertension was defined as increase in SBP > 20% of the baseline value. Tachycardia was defined as increase in HR > 20% of the baseline or HR > 100 bpm, bradycardia was defined as decrease in HR > 20 % of baseline or HR < 50 bpm. These criteria were chosen on the basis of their previous use in other published studies.(12, 14-16) All hypotension, hypertension, tachycardia, bradycardia, arrhythmia, or any allergy to the study drugs and anaesthesia related problems during the period of study were recorded, attended and managed appropriately as per the standard hospital protocol.

Data were entered in Microsoft Excel and analyzed with the statistical package for the social science (SPSS) 26. Quantitative variables such as age, BMI, HR, SBP, DBP and MAP were presented as mean ± standard deviation (SD); and were

compared using a student's t-test. Qualitative variables such as ASA-PS, gender, hypertension, hypotension, bradycardia, and tachycardia were presented as percentage or ratio and were compared using Chi-square test.

Results

Total of 52 patients were enrolled in the study, among which none was excluded. The demographic characteristics (table 1) between two groups were comparable.

Table 1: Patient demographic characteristics

Variables	Group D (n=26)	Group ND (n=26)	p-value
Age (years)	36.65±10.97	36.73±9.59	0.979
BMI (kg/m2)	24.00±2.64	23.12±2.43	0.217
Gender (male: female)	13: 13	11: 15	0.578
ASA-PS (I: II)	17: 9	22: 4	0.109

Baseline mean HR, SBP, DBP and MAP were comparable between both groups. Mean HR (table 2) was significantly lower in group D after induction till 10 min post-intubation. Mean SBP (figure 1), DBP (figure 2) and MAP (figure 3) were significantly lower in group D after induction till 10 min post-intubation.

Table 2: Comparison of mean HR (beat per minute) between two groups

HR	Group D (Mean ± SD)	Group ND (Mean ± SD)	p-value
Baseline	77.08±7.756	81.81±11.426	0.087
After induction	66.38±3.522	86.62±16.850	<0.001*
Just before intubation	67.38±3.060	92.65±16.258	<0.001*
After intubation at 1-min (T1)	69.88±3.179	99.38±17.170	<0.001*
3-min (T3)	66.04±3.092	90.85±15.828	<0.001*
5-min (T5)	65.15±2.989	90.96±15.069	<0.001*
10min (T10)	63.88±2.613	88.77±14.911	<0.001*

* p-value < 0.05

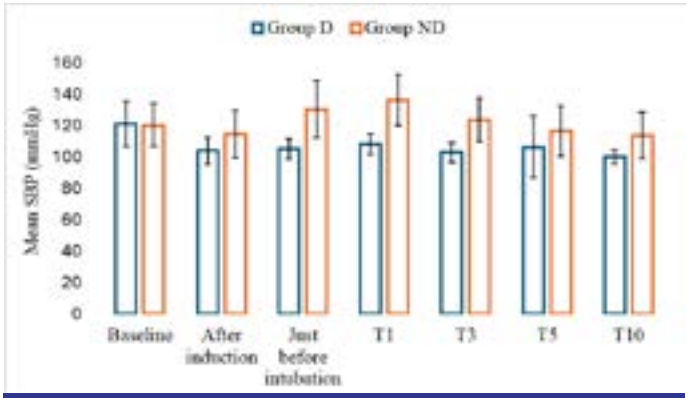

Fig 1: Comparison of mean SBP (mmHg) between two groups.

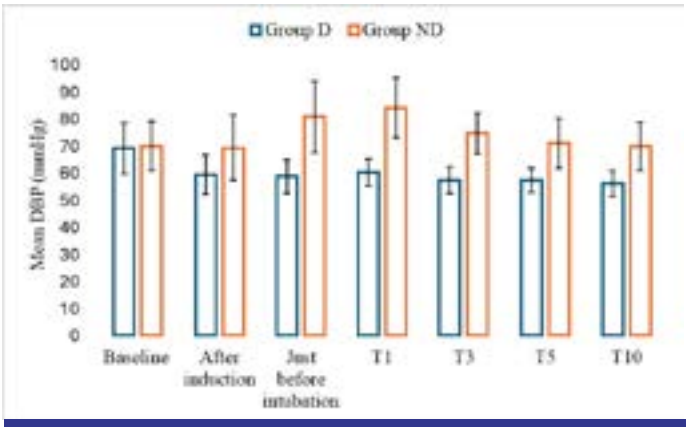

Fig 2: Comparison of mean DBP (mmHg) between two groups.

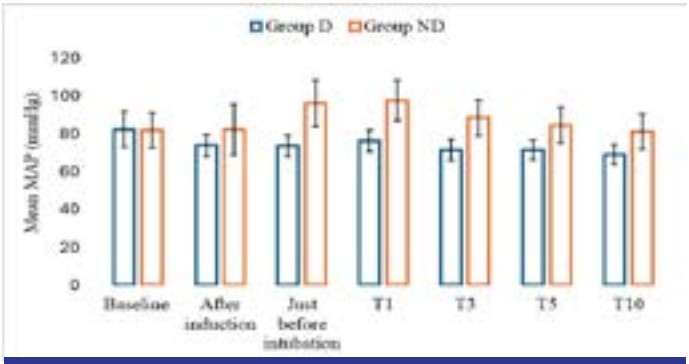

Fig 3: Comparison of mean MAP (mmHg) between two groups.

There were significantly more tachycardia and hypertension (table 3) in group ND.

Table 3: Complications

Complications	Group D	Group ND	p-value
Tachycardia	0	42.307% (11)	<0.001*
Bradycardia	0	0	0
Hypotension	0	3.84% (1)	0.313
Hypertension	0	46.153% (12)	<0.001*
Arrhythmia	0	0	0
Allergy	0	0	0

Values presented in percentage (numbers); *p-value < 0.05.

Discussion

Laryngoscopy and endotracheal intubation are commonly performed basic airway securing technique, associated with unfavorable hemodynamic changes during first few minutes after LETI.[1,2] The possible mechanism for such hemodynamic response can be somatic-visceral reflexes due to stimulus exerted on the base of tongue, activating proprioceptors as well as further recruitment of additional receptors in larynx-trachea, thus enhancing hemodynamic responses.[2,17] Increase in concentration of catecholamines (epinephrine,

norepinephrine and vasopressin) in response to LETI found to be associated with such hemodynamic response.[2, 17, 18] These effects may be well tolerated by healthy individuals. Whereas patients with pathology like, cardiovascular and neurological disorder can lead to arrhythmias, myocardial ischemia, raised intracranial pressure, cerebrovascular accident and increased intraocular pressure.[1, 4, 5, 19]

Even though different attenuating techniques has been implemented but failed to attain clinical and statistical superiority from other. Unlike other sedative drugs, sedation, analgesia, sympatholytic and anxiolysis produced by dexmedetomidine provides respiratory stability without causing ventilatory depression.[8] It is 8 times more potent 2 adrenoceptor agonist compared to clonidine and highly selective alpha2(α2) adrenoreceptor with α2:α1 adrenoreceptor specificity ratio of approximately 1600:1.[8] The action is short-lived with half-time of 2 hours. The onset of action range from 5 to 10 minutes and peak effect is seen for 15 to 30 minutes.[8, 11] Hence induction in our study was done 5 minutes after completion of 10 minutes infusion of dexmedetomidine.

In our study, the mean HR, SBP, DBP and MAP were significantly lower in group D after induction till 10 minutes postintubation compared to the group ND. Remarkably, the mean HR, SBP, DBP and MAP were below baseline in all study time intervals in group D and maximum rise was at 1 min postintubation. But hemodynamic parameters in group ND were fluctuating and above the baseline for most of the study period.

Multiple studies with low dose (0.5 **µ**g/kg) dexmedetomidine have shown comparatively better attenuating effects. In study by Kumari et al.[16] mean HR was significantly low compared to placebo after completion of infusion of dexmedetomidine (0.5 µg/kg) till 15 min postintubation. Whereas mean SBP, DBP and MAP in dexmedetomidine group were significantly low at 1, 3 and 5 min postintubation, but non-significant at 10 and 15 min postintubation. Unlike our study, it can be due to premedication of all patients with oral 0.25mg alprazolam prior to surgery and administration of IV glycopyrrolate 0.2 mg and fentanyl 2 µg/kg 5 minutes after the administration of the dexmedetomidine.

Similarly, Basar et al.[20] despite of different induction (thiopental) and muscle relaxation (vecuronium) agents, mean HR was significantly low most of the study periods in dexmedetomidine (0.5 µg/kg) group compared to saline receiving group. But mean MAP was not significantly lower in dexmedetomidine group, which can be due to rapid IV bolus of dexmedetomidine prepared in 10 ml over 1 min, which likely caused transient increase in MAP.

In Scheinin et al.[21] mean HR, SBP and DBP were significantly low in group receiving dexmedetomidine 0.6 ug/kg compared with group receiving saline from 10 min after drug infusion to 5 min post-intubation and were maximally increased during 10 seconds post-intubation. Unlike our study, this maximum rise for 10 seconds post-intubation can be premedication with glycopyrrolate 5mcg/kg IV and non-opioid induction.

Low dose (0.5 µg/kg) dexmedetomidine has been equally effective in attenuating hemodynamic changes due to LETI, compared to higher dose (1µg/kg). Thapa and Gauchan[9] and Sharma and Mehta[10] found comparable and nonsignificant difference in hemodynamic responses between groups receiving 0.5 µg/kg and 1 µg/kg dose of dexmedetomidine.

In Patel et al.[22] the mean HR, SBP, DBP and MAP in group receiving dexemedetomidine 0.5 mcg/kg were non-significantly higher compared to group receiving dexemedetomidine 1 mcg/kg during most of the study period, which can be due to the use of high dose dexmedetomidine and no use of fentanyl during induction.

On comparison of dexmedetomidine with other blunting agents, low dose dexmedetomidine has shown significant attenuation of intubating reflex. Sarkar et al.[13] found mean HR, DBP and MAP in group receiving dexmedetomidine (0.5 µg/kg) were significantly lower after intubation till 2 min post-intubation compared to group receiving clonidine (3 µg/kg). Whereas mean SBP was significantly lower in dexmedetomidine group after intubation till 10 min postintubation. These findings can be due to comparatively early onset of action of dexmedetomidine compared to clonidine. In another study done by Kewalramani et al.[23] mean HR and SBP were significantly low in dexmedetomidine (0.5µg/kg) receiving group during most of the study period compared to labetalol (0.25µg/kg) receiving group, but mean DBP and MAP were comparable between two groups.

Even though dexmedetomidine seems to have better attenuating effect, it is not devoid of unwanted side effects. Most reported adverse effects are hypotension, hypertension, bradycardia, and tachycardia.[8, 11] The hemodynamic effects of dexmedetomidine result from peripheral and central mechanism showing dose-dependent, blood pressure effect.[24] The transient initial increase in arterial blood pressure followed by hypotension, which is due to vasoconstrictive effects due to rapid IV administration.[11, 24] Hence, dexmedetomidine was infused slowly over 10 minutes to avoid hypertension in our study. The incidence of hypotension and bradycardia can be related to the administration of large intravenous (IV) loading dose.[8, 11, 24]

In our study, dexmedetomidine at a dose 0.5 µg/kg was effective for attenuation of hemodynamic response during LETI , and no adverse reactions were noticed. The incidence of tachycardia and hypertension were significantly higher in group ND. Similar studies[9, 10, 16, 23, 25] using low dexmedetomidine dose of 0.5mcg/kg had shown mixed results with or without adverse effects. Various studies had used higher dosages of dexmedetomidine (1–2 µg/kg) and observed significant attenuation of pressor response to LETI, but associated with high incidence of adverse effects.[9, 10, 26-29] Whereas other studies

using high dose dexmedetomidine of 1mcg/kg, with no any adverse effects.[23, 30]

Conclusion

Dexmedetomidine at a dose of 0.5 µg/kg given as premedication effectively attenuates the hemodynamic response due to laryngoscopy and endotracheal intubation till 10 minutes post intubation.

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Preoperative Use of Gabapentin or Pregabalin on Acute Postoperative Pain Following Laparoscopic Cholecystectomy

Nirman Prasad Gyawali[1], Ashish Ghimire[2], Satyendra Narayan Singh[2]

[1] Department of Anesthesiologist and Intensive Care, National Academy of medical Sciences (NAMS), Bir Hospital, Mahabaudha, Kathmandu, Nepal.
[2] Department of Anesthesiology and Intensive Care, These two are prof of BP Koira a institute of health sciences, Dharan, Nepal.

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Abstract

Introduction: Pain is the earliest most common complain after elective laparoscopic cholecystectomy. Different modalities has been suggested to provide better relief from postoperative pain and to reduce opioid related side effects. Pregabalin or gabapentin on reducing postoperative pain following laparoscopic cholecystectomy has been suggested but comprehensive data regarding the optimal dosage are limited. We designed this study to compare the effectiveness of gabapentin or pregabalin for preemptive analgesia.

Methodology: Seventy two patients undergoing laparoscopic cholecystectomy under general anaesthesia were randomized to receive either gabapentin 600 mg [Group A (n=36) or pregabalin 150 mg [Group B (n=36)] 1 hour before surgery. Intraoperatively hemodynamics were monitored. The duration of analgesia, total doses of rescue analgesics, sedation score and post-operative complications were recorded at 0, 30mins, 1, 2, 6,12 and 24 hours.

Results: Patients in Group B had significantly longer duration of postoperative analgesia as compared to Group A (207.08±54.82min vs 245.97±56.15min p=0.004). Requirement of rescue analgesics for the first 24h was more in Group A (Tramadol 70.83±25mg vs 56.94 ±17.53mg p=0.008). Intra and postoperative haemodynamics, postoperative sedation scores and complications were comparable.

Conclusion: Pregabalin provides longer duration of postoperative analgesia as compared to gabapentin following laparoscopic cholecystectomy.

Introduction

The response to pain differs among different individuals as well as in the same person at different times.[1] Inadequate relief of postoperative pain can contribute to significant morbidity, resulting in delay of recovery and return to daily activities.[2] Large percentage of patients reported to have experienced moderate to severe pain, particularly after laparoscopic cholecystectomy procedures.[3] After laparoscopic cholecystectomy three components of acute postoperative pain have been described : incisional pain, visceral deep pain and shoulder referred pain.[4]

Traditionally, opioids were the mainstay of management of pain in postoperative patients. However, opioid analgesics have various side effects like nausea, vomiting, constipation, urinary retention, drowsiness, respiratory depression in large doses, acute opioid tolerance, opioid induced hyperalgesia and delayed discharge.[5-8] There is increasing interest towards alternatives to systemic opioids for managing postoperative pain and an analgesic regimen with multimodal approach

Correspondence:
Nirman Prasad Gyawali, Department of Anesthesiology and Intensive Care, National Academy of medical Sciences (NAMS), Bir Hospital, Mahabaudha, Kathmandu, Nepal.
Email: gyawalinirman@gmail.com

has been suggested to improve analgesia and to reduce opioid related side effects.[9]

Gabapentinoids cause reduction in central sensitization which decreases acute postoperative pain.[10] Pregabalin is a structural analog of gamma amino butyric acid (GABA).[11] Pregabalin has a role in treatment of acute postoperative pain by decreasing the excitability of dorsal horn neurons caused by tissue damage.[12] Pregabalin and gabapentin were originally developed as spasmolytic agents and adjuncts for the management of generalized or partial epileptic seizures resistant to conventional therapies.[13] Gabapentin has been found to be effective in treating a variety of chronic pain conditions, including post-herpetic neuralgia, diabetic neuropathy, complex regional pain syndrome, central pain, malignant pain, trigeminal neuralgia and headaches.[14] Gabapentin has been found to be useful for neuropathic pain[14] and postoperative pain after breast surgery,[15] spinal surgery,[16] and laparoscopic cholecystectomy.[17]

The aim of our study was to evaluate the duration of effective analgesia and compare the requirement of rescue analgesia in the first 24 hours postoperatively in patients undergoing laparoscopic cholecystectomy under general anaesthesia.

Methodology

This was a Prospective Comparative Clinical Study conducted in the department of Anaesthesiology and Critical Care, BPKIHS. After ethical approval from the BPKIHS Institutional Review Committee (IRC/1094/017), 72 patients scheduled for laparoscopic cholecystectomy were included. The inclusion criteria for our study were; patients of either gender undergoing elective laparoscopic cholecystectomy under general anaesthesia in the age group (18-65 years) with ASA physical status I and II. The exclusion criteria were; not willing to participate in the study, allergy or any contraindication to study medication, patients with neurological and psychiatric disorders, coagulopathy. Drugs used for the study were, 600mg of gabapentin (2 capsules of 300mg) and 150 mg of pregabalin (2 capsules of 75 mg) and the patients were followed till 24 hours after the surgery.

An informed written consent was obtained for the procedure from all the patients who participated in the study. During the pre-anaesthetic checkup (PAC), the patients were familiarized and explained about the Numeric Rating Scale (NRS) score for pain assessment. Group allocation was done after arrival of the patient in the patient holding area of the operation theatre. Group A patients received 600mg gabapentin and Group B received 150mg pregabalin, approximately one hour prior to surgery. The study drug was given by the anaesthesiologist not involved in monitoring the outcome variables.

At the operation theatre, non invasive blood pressure (NIBP) cuff, electrocardiography (ECG) leads and pulse oximetry (SpO2) probe were attached to the patient and the baseline ECG, NIBP, respiratory rate (RR), heart rate (HR) and SpO2 were monitored. After IV access, preoxygenation was done for three minutes using 100% oxygen. General anaesthesia was induced with fentanyl 1.5µg/kg IV, and propofol 1.5-2.5mg/kg IV till the patient slept. Vecuronium bromide 0.1 mg/kg IV was given and tracheal intubation facilitated. Anaesthesia was maintained with a mixture of oxygen with air and Isoflurane to maintain end tidal carbon dioxide (ETCO2) between 35 to 45 mm Hg. The surgery was performed using standard four port technique for laparoscopic cholecystectomy in all patients. Ketorolac 30 mg IV and ondansetron 4 mg IV was given intraoperatively. In both groups, paracetamol 15 mg/kg IV, not exceeding 1 gm was infused intraoperatively. At the end of the surgery, 20 ml of 0.25% plain bupivacaine was instilled in gall bladder fossa. Then 10 ml of 0.25% plain bupivacaine was infiltrated at the port sites. Isoflurane was discontinued after the last skin suture.

Awake extubation was done after reversing with neostigmine 0.05 mg/kg IV and glycopyrrolate 0.01 mg/kg IV after which patients were transferred to the PACU. All the patients received IV Paracetamol at the dose of 15mg/kg (not exceeding 1 gm) every 6 hourly in the postoperative period.

In the post anaesthesia care unit (PACU), then at 0, 30 minutes,1,2,6,12 and 24 hours respectively, pain and sedation were assessed. Pain intensity was measured by using a Numeric Rating Scale score at rest and on movement, 0 being no pain and 10 being the worst pain imaginable. Postoperative sedation was assessed by the Modified Ramsay's sedation scale (MRSS).

Adverse effects attributable to study drugs in the postoperative period were noted such as headache, bradycardia (HR <50 bpm), nausea, vomiting, dizziness, somnolence, respiratory depression.

Management of pain

Injection tramadol 50 mg was given slowly IV every time the patient asked for analgesia or when the NRS score was more than 3. The time of administration of rescue analgesic was noted and the total amount of analgesic drug consumed during the study period was noted.

Data was entered in Microsoft Excel 2016 and converted into Statistical package for social sciences (SPSS 11.5) for statistical analysis. For descriptive statistics, percentage, proportion, mean, median, standard deviation, Interquartile range as appropriate was calculated along with graphical and tabular representation of data. For inferential statistics, Chi square test and Independent t-test was applied to find out the significant differences between the groups with selected clinical variables and socio-demographic characters at 95% Confidence Interval and probability of significance (P) <0.05.

Results

This study showed no statistical significance in the demographic and operative variables like age, gender and body weight between the two groups.

Table 1: Summary of demographic characterstics

Variables	Group A(n=36)	Group B(n=36)	p value
Gender(M/F)	11/25	14/22	
Age(years)	40.78±13.74	40.39±13.73	0.905
Weight(kg)	63.86±6.26	62.56±10.10	0.512

Similarly, our study showed no statistical significance in preoperative vital parameters and intraoperative haemodynamic parameters among the two groups.

Table 2: Duration of effective analgesia and requirement of rescue analgesics in first 24 hours

Observation	Group A(n=36)	Group B(n=36)	p value
Duration of effective analgesia	207.08±54.82 min	245.97±56.15 min	0.004*
Requirement of rescue analgesia (Tramadol)	70.83±25 mg	56.94 ±17.53 mg	0.008*

* p value statistically significant

As with other parameters, level of sedation was also assessed at 0min, 30 min,1, 2, 6, 12 and 24 hours during the postoperative period using the Modified Ramsay Sedation Scale (MRSS). The MRSS among the two groups at various points in time was found to be statistically insignificant (p>0.05).

Table 3: Comparison of MRSS between two groups at various time

Time	Group A (n=36)		Group B (n=36)		p value
	Mean ±SD	Median	Mean ±SD	Median	
0 min	1±0	1	1±0	1	1.000
30 min	1±0	1	1±0	1	1.000
1 h	1.92±0.28	2	2±0	2	0.079
2 h	2±0	2	2±0	2	1.000
6 h	2±0	2	2±0	2	1.000
12 h	2±0	2	2±0	2	1.000
24 h	2±0	2	2±0	2	1.000

The common adverse effects observed during the study were dizziness, somnolence and headache. These adverse effects were observed in both the study groups. However, these comparisons were statistically insignificant.

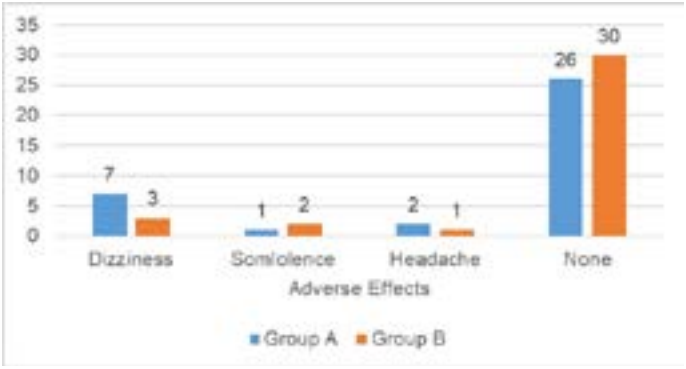

Fig 1: Adverse effects observed in the two groups of patients

Discussion

The present study aimed to compare the duration of effective analgesia along with other parameters (hemodynamic changes, complications, sedation and requirement of rescue analgesia) of orally administered low yet effective dose of gabapentin and pregabalin following laparoscopic cholecystectomy under general anaesthesia. Till date various studies have been undertaken to determine as well as to compare the effectiveness of pregabalin and gabapentin in the control of post-operative pain, either as preemptive analgesics, preventive analgesics or even during the post- operative period. Various studies support the conclusion that perioperative use of gabapentinoids reduce early postoperative pain and opioid use. Evidences support gabapentin in reducing early postoperative pain and there is also sufficient evidence for clinicians to choose pregabalin as an alternative.[18] Studies have demonstrated that patients receiving 600, 900 and 1200 mg of gabapentin had lower visual analog scale score than those receiving 300mg or placebo. Studies have also found that 150 mg not 75 mg of pregabalin was superior in reducing postoperative opioid consumption and pain scores.[18] The lowest effective oral doses of 600 mg of gabapentin and 150 mg of pregabalin were thus used in our study.

The present study has demonstrated statistically significant prolonged duration of effective analgesia in patients with 150 mg oral pregabalin (245.97 ± 56.15 min) in comparison to 600 mg gabapentin (207.08 ± 54.82 min) when administered approximately one hour before surgery. Maqsood et al,[19] in their study, concluded that preoperative use of pregabalin provides significantly prolonged postoperative analgesia compared to gabapentin after open cholecystectomy. Mishra et al,[10] in their study found that pregabalin group had lower pain score and prolonged timing of first rescue analgesic which was comparable to our study. Akin to the findings of our study Ghai A[20] and colleagues found that patients in gabapentin group required analgesic earlier and more than patients in pregabalin group. Pandey et al,[17] in their study on the role of gabapentin as postoperative analgesic in laparoscopic cholecystectomy demonstrated that the

total fentanyl consumption postoperatively was significantly less in gabapentin group than in the tramadol group and placebo group. The requirement of higher dose of analgesia in gabapentin than pregabalin group was shown by Mishra et al,[10] which is similar to our study. Our findings were also supported by Bafna et al[21] and Saraswat et al[22], who observed that preemptive pregabalin or gabapentin significantly reduced the post-operative analgesia requirement after regional spinal anaesthesia.

The hemodynamic parameters were stable throughout the period of study {intra operative and post operative} . Similar to our study, Routray et al[23] also concluded that there was no significant difference in the hemodynamic parameters both intraoperatively and postoperatively among the gabapentinoid groups. Mishra et al,[10] observed that no significant statistical difference in between the groups in their study which is similar to ours. In our study, the complications were categorized as headache, dizziness and somnolence. Somnolence was evaluated using Modified Ramsey Sedation Scale (MRSS) where a scale of ≥2 was considered to be sedated. The sedation score, occurrence of headache and dizziness between the two groups of our study were all comparable. Contrary to our findings of the sedation scores, Mishra et al,[10] found that postoperative sedation was significantly more in the pregabalin group till 3 hours postoperatively compared to the gabapentin and placebo groups. Study conducted by Routray et al[23] favoured our study in that the complications such as dizziness, sedation, nausea, vomiting, headache, and respiratory depression did not show any statistical significance. Similar observations of no significance in the postoperative complications including at least the sedation score, headache and dizziness between the two groups were made by Ghai et al[20] and Saraswat et al.[22]

Similarly, study with different doses of both gabapentin and pregabalin needs to be done to arrive at an appropriate analgesic dose. We have not included a control group in our study, thus we could not observe the analgesic effects of pregabalin and gabapentin alone.

Conclusion

A single preoperative dose of oral pregabalin 150 mg is more effective as preemptive analgesia in comparison to gabapentin 600mg for the management of postoperative pain following laparoscopic cholecystectomy with minimal side effects.

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Comparison of Epinephrine and Vasopressin as Second line Vasopressor in Patients with Septic Shock

Bikash Adhikari, Sindhu Khatiwada, Balkrishna Bhattarai, Satyendra Narayan Singh, Asish Subedi

Department of Anesthesiology, B.P. Koirala Institute of Health Sciences, Dharan, Nepal.

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Abstract

Introduction: Septic shock continues to be a significant contributor of ICU mortality. Norepinephrine stands as the primary choice for vasopressor therapy. Either epinephrine or vasopressin is added to norepinephrine or vasopressin to attain the desired mean arterial pressure target. Head-to-head comparisons of these second-line options are scarce. We aimed to compare the effect of epinephrine and vasopressin on 7-day and 28-day mortality, occurrence of acute kidney injury, the duration of mechanical ventilation, as well as the lengths of stay in the ICU and hospital among patients diagnosed with septic shock.

Methodology: Our study included 22 adult patients diagnosed with septic shock who were admitted to the intensive care unit (ICU). When the dose of norepinephrine reached 15 mcg/min, either epinephrine (Group E) or vasopressin (Group V) was added according to the discretion of attending intensivist. Patients were followed-up for a period extending up to 28 days following the initiation of these vasopressors.

Results: In this study of septic shock patients in ICU, epinephrine (n=7) vs. vasopressin (n=15) showed similar 7-day mortality (57% vs. 67%, p=1) and 28-day mortality (0% vs. 7%, p=0.6). While Acute Kidney Injury rates were comparable (71% vs. 47%, p=0.38), epinephrine significantly shortened ventilation (2.8 vs. 5.2 days, p=0.04) and ICU stay (3.2 vs. 5.6 days, p=0.03). Duration of hospital stay remained similar (4.5 vs. 6.4 days, p=0.17).

Conclusion: Administration of either epinephrine or vasopressin as a second line vasopressor has similar effect on 7 and 28-day mortality, incidence of acute kidney injury and the overall duration of hospital stay. Nevertheless, individuals administered with epinephrine experienced a reduced duration of mechanical ventilation and shorter ICU length of stay.

Introduction

Septic shock is defined as sepsis accompanied by hypotension that does not respond with fluid resuscitation.[1] It stands as the primary cause of fatalities in the Intensive Care Unit (ICU) and holds significant importance as a healthcare priority.[2,3] Crucial to the management of septic shock is the prompt initiation of empiric antibiotics, along with resuscitation through fluids and vasopressors.[4,5] Contemporary guidelines for managing septic shock advise the use of norepinephrine

Correspondence:
Bikash Adhikari, Department of Anesthesiology, B.P. Koirala Institute of Health Sciences, Dharan, Nepal.
Email: prayas.garchu@gmail.com

as the primary vasopressor for adults who fail to reach the target mean arterial pressure (MAP) following initial fluid resuscitation.[1] If norepinephrine proves inadequate in achieving the target mean arterial pressure (MAP), either vasopressin or epinephrine is introduced as an adjunct.[1,5] Studies on head-to-head comparison on outcomes between epinephrine and vasopressin is scarce. A retrospective study indicated no difference in 28-day mortality among patients who were administered either epinephrine or vasopressin.[6]

Our goal was to assess and contrast the impact of epinephrine and vasopressin as second-line vasopressors on the 7-day and 28-day mortality rates in patients with septic shock. Additionally, our secondary objectives included comparing the incidence of acute kidney injury, as well as the durations of mechanical ventilation, ICU stay, and hospital stay.

Methodology

A prospective comparative study was designed to include patients aged 18 years and older who were admitted to the ICU with septic shock at a tertiary care hospital in eastern Nepal.

This study was done from December 2019 to November 2020 in 22 adults consecutively admitted in ICU with septic shock requiring initiation of vasopressor for management of hypotension. Ethical clearance from the Institutional Review Committee, BPKIHS (ref no. Acd/422/077/078), and written informed consent were taken from the patient's relative. Patients transferred from another hospital already on vasopressor, receiving vasopressor other than norepinephrine, with cancer, chronic heart disease (NYHA III/IV) and pregnancy were excluded.

Management of septic shock in all patients adhered to the recommendation by Surviving sepsis campaign.[5] Following the resuscitation with 30 ml/kg of crystalloid within the initial three hours of diagnosing septic shock, if the target mean arterial pressure of 65 mm Hg was not attained, the vasopressor norepinephrine was initiated at a starting dose of 5 mcg/min. Norepinephrine was increased by 2.5 mcg/min every 10 minutes targeting MAP of 65mm Hg to a maximum of 15 mcg/min. Second line vasopressor was started at the discretion of the treating intensivist. Vasopressin was started at 0.6 U/min and was increased by 0.3 U/min every 10 minutes to a maximum of 1.8 U/min. Epinephrine was started and increased in a same dose as norepinephrine. If the target MAP was not achieved using two vasopressors, a third agent was added. Group V received vasopressinwhile Group E receivedepinephrine. Dobutamine was introduced for patients exhibiting a sustained elevation in lactate levels despite sufficient fluid administration and the utilization of vasopressors.. If hemodynamic stability was not achieved using fluid and vasopressors, intravenous hydrocortisone was started at a dose of 50mg/dose 6 hourly (200 mg/day). Resuscitation with fluids, vasopressor and blood was guided to normalize lactate levels if elevated. Patients were followed up extending up to 28 days after the initiation of either epinephrine or vasopressin. The study took note of the 7-dayand 28-day mortality rates, the incidence of acute kidney injury, the length of mechanical ventilation, as well as the durations of ICU and hospital stays. Acute kidney injury was defined as increase in serum creatinine by ≥ 0.3 mg/dl within 48 hours or increase in serum creatinine to ≥1.5 times baseline, or urine volume < 0.5 ml/kg/h for 6 hours.[7]

The principal investigator, who had no role in making management decisions for patients, conducted the data collection. Only the patients were blinded regarding the type of vasopressor used. Gathered data was entered in Microsoft excel 2007 and analyzed using SPSS 11.5 version (IBM SPSS, Inc. Chicago, IL, USA 11.5). Descriptive statistics, including percentage, mean ± SD, median, and interquartile range, were calculated, and the results were presented in tabular form. The normality of quantitative variables was assessed using the Kolmogorov-Smirnov test. For inferential statistics, Chi-square test was employed to examine the mortality differences between the two groups. Mann Whitney test was applied to find the significant difference between demographic and baseline parameter as well as duration of hospital stay, mechanical ventilation and ICU stay at 95% confidence interval where level of significance was < 0.05.

Results

Of 22 patients, 7(32%) received epinephrine and 15(68%) received vasopressin. Age of the patients ranged from 21-77 years. Thirteen (59%) patients were female and 9(41%) were male (Table 1).

Table 1: Demographic and baseline characteristics

Parameters	Group E(n=7)	Group V(n=15)	P value
Sex (M: F)	3:4	6:9	1.0*
	Mean (±SD)	Mean (±SD)	
Age(years)	46.0±21.1	43.07±15.9	0.72**
HR (per min)	131.1±16.2	121.6±14.1	0.17**
RR (per min)	30.2±4.2	28.0±5.9	0.37**
MAP (mm Hg)	53.3±5.7	56.4±4.9	0.21**
Fluid volume before inotropes (ml)	1671.4±281.5	1826.6±393.6	0.33**
APACHE II score	16.5±8.1	21.3±8.3	0.22**

*Chi-square test ** Mann Whitney test

The most common foci for sepsis wasabdomen, which was in 7(46.6%) patients of Group V and 4(57.1%) patients of Group E. Number of patients with 7-dayand 28-day mortality was comparable in both the groups (Table 2).

Table 2: Comparison of outcomes between groups

Parameters	Group E (n=7)	Group V (n=15)	P- value
7-daymortality (No. of patient)	4(57%)	10 (66.6%)	1.0*
28-daymortality (No. of patient)	4(57%)	11(73.3%)	0.6*
Acute kidney injury (No. of patient)	5(71%)	7(47%)	0.38*
	Mean (±SD)	Mean (±SD)	
Duration of mechanical ventilation (mean days)	2.8±1.8	5.2±2.5	0.04**
Duration of ICU stay (mean days)	3.2±1.5	5.6±2.7	0.03**
Duration of hospital stay (mean days)	4.5±1.4	6.4±3.2	0.17**

*Chi-square test **Mann Whitney test.

The average duration of vasopressor support was 13.47 days in group V and 7.29 days in Group-E, (p=0.03). Addition of third vasopressor was required in 5(33.3%) patients of group V and in one (14.2%) patient of group E, (p=0.61).

Discussion

The occurrence of septic shock is steadily on the rise, with approximately 1,500,000 cases of sepsis and septic shock reported annually in North America, and an additional 1,500,000 cases in Europe.[4] The in-hospital mortality rates can be substantial, reaching up to 25-30% for sepsis, and 80% for septic shock.[8] The reported in-hospital mortality rate for patients with septic shock admitted to Asian ICUs stands at 44.5%.[9]

This study aimed to evaluate the impacts of vasopressin and epinephrine as second-line vasopressors in the management of patients with septic shock. The findings reveal that the addition of either vasopressin or epinephrine to norepinephrine has comparable effects on 7-day and 28-day mortality, the incidence of acute kidney injury, and the overall duration of hospital stay. However, it is noteworthy that patients receiving vasopressin exhibited a longer duration of mechanical ventilation and ICU stay compared to those receiving epinephrine.

The surviving sepsis guidelines advocates norepinephrine as primary vasopressor and proposes vasopressin if MAP is inadequate on norepinephrine. Epinephrine is recommended for patients with inadequate MAP on norepinephrine and vasopressin.[10] Very few studies have a direct comparison of these two agents as second line drug in terms of mortality outcome and this study attempted to do so.

In our study, 10 out of 15 patients (66%) in the vasopressin group and 4 out of 7 patients (58%) in the epinephrine group died within 7 days of initiating the second vasopressor. Similarly, 11 patients (73%) in the vasopressin group and 4 patients (53%) in the epinephrine group experienced mortality within 28 days of initiating the second vasopressor. Although the number of patients who died within seven day and 28 days were more in patients receiving vasopressin as compared to epinephrine, the result was not statistically different. Similar reports on mortality were obtained by Menich et al.[11] and Kim et al.[6] However, studies done by Mullner et al.[12] and Hall et al.[13] failed to establish any significant association between vasopressors.

The available data do not conclusively establish a superior survival benefit associated with the use of any specific catecholamine or their combinations in the management of septic shock. Substantial evidence points to individual variations in responses to catecholamines, potentially stemming from differences in volume status, the duration of septic shock, the urgency of its management, phenotypic variations in responsiveness to endotoxin and other inflammatory mediators, coupled with potential downregulation and/or impairment of catecholamine receptors.[14] It has also been postulated that survival of patients with septic shock is dependent on norepinephrine responsiveness. Subsequent requirement of second- and third-line vasopressor agents implies state of non-responsiveness to norepinephrine as well as increasing severity of illness. The restoration of blood pressure may not necessarily lead to improved outcomes in septic shock if the elevated blood pressure is concomitant with a deterioration in cardiac performance, reduced cardiac output, and diminished oxygen delivery.[15] Exceeding mortality rates were observed in patients who administered with higher than 1 μg/kg/min NE in retrospective studies by Brown et al.[16] and Martin et al.[17]

AKI is defined as a rise in serum creatinine by ≥ 0.3 mg/dl within 48 hours, or an increase in serum creatinine to ≥ 1.5 times the baseline, known or presumed to have occurred within the prior 7 days, or a urine volume less than 0.5 ml/kg/h for 6 hours.[7] Seven (out of 15) percent of patients receiving vasopressin and five (out of 7) patients receiving epinephrine developed AKI during their course of treatment in ICU, in our study. However, the result was statistically insignificant.

Improvement in renal function of patients receiving vasopressin for management of hypotension has been reported by Tsuneyoshi et al.[18] However, vasopressin infusion was started very early during the course of management and continued for 16 hours and no comparison was made

between vasopressors. Most of the patients in this study had a very low MAP (mean 55.45 mm Hg) and also had deranged renal function before enrollment in the study and because the increment in blood pressure would by itself increase urine output, lack of association of occurrence of AKI between two groups is reported in our study.

In our study, the duration of mechanical ventilation was notably shorter in patients receiving epinephrine compared to those receiving vasopressin. (p value = 0.046). The total dose of norepinephrine used during the course of treatment in ICU was higher in patients receiving vasopressin compared to epinephrine in our study. Likewise, the overall duration of support with vasopressors was notably longer in the vasopressin group. This could be one of the reasons why the patients in vasopressin group required mechanical ventilation for longer duration. Yamamura et al.[19] also reported reduced duration of mechanical ventilation in patients who were administered lower dosage of norepinephrine. However in a recent large randomized, double-blind, placebo-controlled, multi-center clinical trial (SEPSIS-ACT), performed in patients with septic shock receiving NE, administration of selepressin, compared with placebo, did not increase vasopressor-free days and ventilator-free days within 30 days.[20]

The duration of ICU stay of patients receiving vasopressin was longer compared to patients receiving epinephrine in our study. This is expected as the patients receiving vasopressin required mechanical ventilation for longer duration. Kim et al.[6] documented a comparable duration of ICU stay and ventilator days in patients receiving either vasopressin or epinephrine as a second-line vasopressor for the management of septic shock. Though the duration of ICU stay was comparable in this study, ventilator requirements were more in vasopressin group. Nevertheless, Menich et al.[11] found no disparity in the duration of mechanical ventilation in patients receiving either vasopressin or epinephrine as a second-line vasopressor for the management of hypotension, aligning with the findings in our study.

Limitation: Although statistically insignificant, patients receiving vasopressin stayed in hospital for longer duration as compared to epinephrine in this study.

First, this study lacked a control group. Second, there was discrepancy in the number of patients in two groups. This was likely due to selection bias because the initiation of the second vasopressor was at the discretion of the treating physician. Finally, the sample size was small because the study was halted due to covid 19 pandemic.

Further study can be done in larger population with adding control group. Furthermore, participants and physicians should be blinded to add strength to the study.

Conclusions

The supplementation of either vasopressin or epinephrine to norepinephrine demonstrated comparable effects on seven-day and 28-day mortality, the incidence of acute kidney injury, and the overall duration of hospital stay in patients with septic shock. Nevertheless, patients receiving vasopressin experienced a prolonged duration of mechanical ventilation and ICU stay compared to those receiving epinephrine. Due to the limited sample size, additional research with a larger cohort is necessary to better determine the optimal choice between epinephrine and vasopressin as a second-line vasopressor in patients with septic shock.

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Case Report

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Ultrasound Guided Localization of Inferior Gluteal Artery for Identification Sciatic Nerve: A Case Report

Prajjwal Raj Bhattarai, Anup Bista, Hemant Adhikari

Department of Anesthesia and Pain management, Nepal Mediciti Hospital, Nakhu, Bhaisepati, Lalitpur, Nepal.

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Abstract

Various approaches to sciatic nerve blocks at different levels have been described. In the nineteenth century, landmark techniques were employed for the nerve block, while nowadays, ultrasound-guided nerve blocks are gaining popularity. Despite the array of techniques available, challenges arise due to factors like the intricate gluteal anatomy, challenging sonoanatomy, patient positioning issues, and the learning curve associated with ultrasound and nerve locators. Among these landmarks, the inferior gluteal artery stands out as an easily identifiable feature with ultrasound assistance.

We report a case where we used ultrasound to locate the inferior gluteal artery that guides in the identification of the sciatic nerve. In this t echnique, we can identify the nerve immediately as it emerges from the greater sciatic notch. At this level, we can block the nerve to achieve adequate surgical anesthesia and analgesia for tourniquet pain.

Introduction

The sciatic nerve is the mixed nerve and its course from the sciatic plexus to the popliteal region provides different levels to block the nerve along its pathway. Complexity of gluteal anatomy, level of expertise of the anesthesiologist and the unavailability of devices like the ultrasound, the nerve stimulators make the sciatic nerve blocks technique challenging. Numerous techniques for sciatic nerve block have been described, ranging from various landmark-based approaches to ultrasound-guided methods, which can be confusing for novice practitioners. In 1920 Victor Pauchet first described the landmark technique to block that was popularized as the Labat technique by Gaston Labat in 1923. In 1975 Alon Winnie modified the Labat approach. In 1963 George Beck described anterior approach and in 1975 Prithvi Raj described lithotomy approach to block the sciatic nerve in the supine position. The landmark parasacral approach was first described by Mansour in 1993.[1]

Sciatic nerve is a flat and thick nerve with branching starting proximally. These proximal branches supply the posterior-superior aspect of thigh. These branches have to be blocked along with femoral and lateral cutaneous nerve of the thigh to achieve anesthesia for tourniquet application.

In this report, we used ultrasound long with the nerve stimulator in localization of the sciatic nerve. Inferior gluteal artery is adjacent to the nerve and might serve as a novel ultrasound landmark for proximal sciatic nerve blocks. We performed femoral and lateral cutaneous nerve block to achieve surgical anesthesia and analgesia for tourniquet application in a covid positive patient posted for right foot surgery.

Case presentation

A 26-year-old gentleman, ASA PS I, who suffered a road traffic

Correspondence:
Prajjwal Raj Bhattarai, Department of Anesthesia and Pain management, Nepal Mediciti Hospital, Nakhu, Bhaisepati, Lalitpur, Nepal.
Email: prajjwal.bhattarai@gmail.com

accident where he had crush injury of the right foot with second, third and fourth metatarsal fractures. He had multiple laceration injuries in face, low back area and posterior aspect below the knee. The orthopedic surgeonplanned emergency debridement of the right foot, and k-wire fixation of the metatarsal fractures. The surgery required tourniquet application in thigh.

On evaluation, the patient had a history of fever and cough since 5 days and was taking over the counter medications. There were no other comorbidities. As per our hospital protocol, the trauma series imaging, pre-operative panel, and RT-PCR for COVID-19 were done. The imagings of the other systems and pre-operative panels were within normal limits. However, the RT-PCR reported positive.

The central neuraxial technique was contraindicated as there was laceration at the L1-L5 area. General anesthesia can generate airborne particles of COVID, hence we opted for peripheral nerve blocks for performing surgery. We explained the risks and benefits of the technique and we obtained informed consent. Affirming adequate nil per oral tatus, we shifted the patient to the operating room.

ASA standard monitoring device was attached. First we performed the right sciatic nerve block by positioning the patient on the left lateral position with the right lower limb on the non- dependent side. Slight flexion of the lower limb was done .

Electrode of the nerve stimulator was attached to the limb and the current setting was adjusted. Under all aseptic preparation, the Curvilinear probe (2-5Hz, Acuson P500, Siemens) as placed at a transverse position just inferior to the posterior superior iliac spine (PSIS) which was identified by palpation and skin dent. The ultrasound showed a hyperechoic image which is the posterior border of ilium (PBI). Then the probe was moved caudally and discontinuation in the ilium was visualized which is the sciatic notch. With slight caudal tilt of the probe, a pulsating image - Inferior gluteal artery was seen along with a hyperechoic image - Sciatic nerve was visualized lateral to inferior gluteal artery. The echogenic needle 10 cm (sonoplex, Pajunk), connected to the nerve stimulator was inserted from the lateral side. When the needle approximated the nerve, the plantar flexion was noticed. Adjustment in the current amplitude was done. 20 ml of 0.5% Bupivacaine was injected.

After completion of the sciatic nerve block, the patient was repositioned to supine for the right femoral nerve block. Under all aseptic preparation, Linear ultrasound probe (5-13 Hz,Acuson P500, Siemens) was placed transversally just beneath the inguinal crease. Femoral nerve is visualized as hyperechoic structure just lateral to the artery and femoral nerve block was done by inserting the sonoplex needle from the lateral side. Contraction of the quadriceps muscle was visualized by adjusting the current settings in the nerve stimulator. 10 ml of 0.5% Bupivacaine was injected. After completion of femoral nerve block, The linear probe was moved laterally and the lateral femoral cutaneous nerve was identified in a fat filled cavity between sartorius and tensor fascia latae muscles and 3mls of bupivacaine was injected.

Within 20 minutes surgical anesthesia was achieved and the surgery was completed uneventfully. Adverse effects were not observed while we followed up on the first postoperative day.

Discussion

This case illustrates an ultrasound-guided Sciatic Nerve block for lower limb surgery in an unusual situation where spinal anesthesia was contraindicated and GA needs to be better avoided due to Covid 19 positive status. In the situation of covid 19, the regional anesthesia practice avoids the need for General Anesthesia. Ultrasound technology has become an indispensable tool in operation theatres, ICUs, and pain clinics, owing to its versatility and non-invasive nature. In the operation theatre, ultrasound is commonly employed for real-time imaging during procedures, like central venous catheter placement and arterial line insertion and in nerve blocks, guiding needle placements with precision. In the ICU, ultrasound serves as a valuable diagnostic and monitoring tool, allowing physician to assess lung and cardiac function, inferior venacava diameter and diaphragm excursion measurement. Additionally, ultrasound plays a crucial role in pain clinics by enabling physicians to precisely identify anatomical structures, assess joint and soft tissue abnormalities, and guide interventions like nerve blocks and injections, contributing to improved accuracy and efficacy in pain management.

Greater sciatic foramen (GSF) is visualized as a gap between the posterior border of ilium laterally and scarum medially. The piriformis muscle divides GSF into superior and inferior halves. Thesuperior gluteal artery and nerve arises from superior GSF and the sciatic nerve along with nerve to quadratus muscle, the inferior gluteal vein and artery and the inferior gluteal nerve; and posterior femoral cutaneous nerves; the internal pudendal artery and veins, and the nerves to the internal obturator and quadratus femoris muscles emerges from inferior GSF. In the view of complexity anatomy, ultrasound view of the gluteal region to identify the sciatic nerve is cumbersome.

The sciatic nerve is formed from the L4 to S3 root of the Lumbosacral plexus and emerges from the pelvis through the greater sciatic foramen (GSF) under the piriformis muscle and runs between the ischial tuberosity and greater trochanter.

Inferior gluteal artery arises from the anterior division of the internal iliac artery and descends through the lower portion of greater sciatic foramen.

The sciatic nerve lies lateral to the inferior gluteal artery in inferior GSF. It is the most proximal part of the sciatic, visible by the ultrasound in the gluteal region.

We followed these steps to identify the sciatic nerve reliably (multimedia link for the steps). https://youtu.be/zO-iVTP5ZcI

1. Palpate the PSIS and place the probe just below it, transversely.
2. We can get the image of PBI as the hyperechoic shadow. (Fig: 1)
3. Slide the probe inferiorly, we can visualize GSN.(Fig: 2)
4. At this point, we will visualize the inferior gluteal artery as a pulsatile structure. (Fig: 2)
5. We tilt the probe caudally, we can visualize the sciatic nerve as triangular hyperechoic shadow. (Fig: 3)

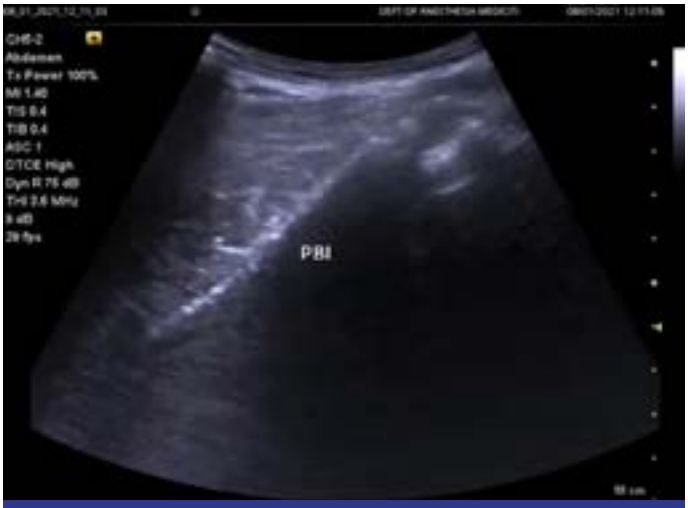

Fig 1: Ultrasound image of Transverse section of gluteal area

PBI posterior border of ilium

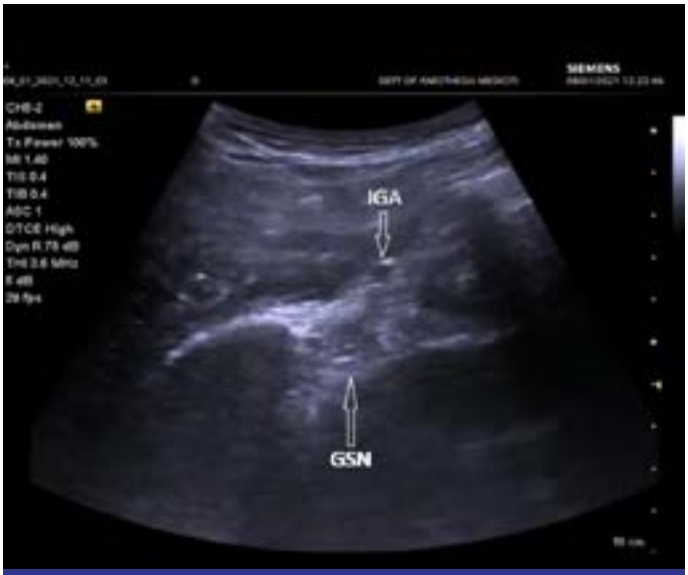

Fig 2: Ultrasound image of Transverse section of gluteal area

(IGA: Inferior Gluteal Artery SN: Sciatic Nerve GSF: Greater Sciatic Foramen)

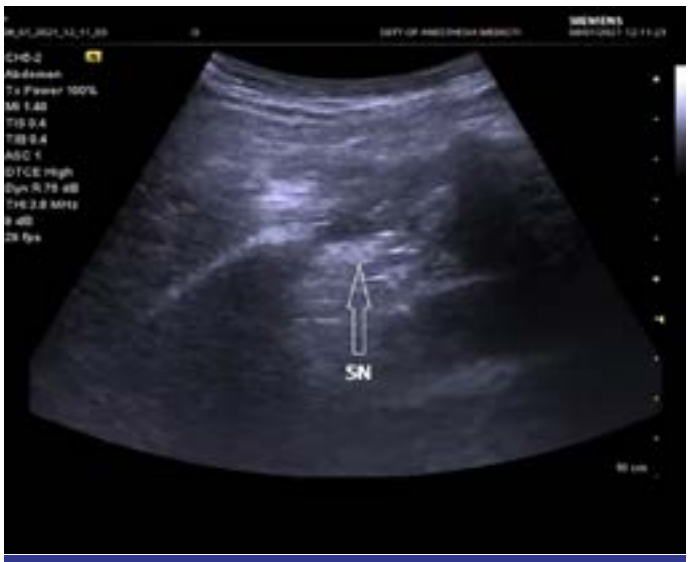

Fig 3: Ultrasound image of Transverse section of gluteal area

SN: Sciatic Nerve

The success rate is high if we are able to block the nerve proximally. Elsharkawy et al conducted a retrospective study on Ultrasound Detection of ArteriaComitans to locate the sciatic nerve. They found arteriacomitans accompany the sciatic nerve for a short distance and then penetrate the nerve and run to the lower part of the thigh[2]. Similarly, Dillow et al found a 100% success rate of Ultrasound-guided parasacral approach to the sciatic nerve block in children where they were able to localize inferior gluteal artery[3].

Ultrasound (US) has a pivotal role for performing regional anesthesia. US aids to identify the structures of interest, avoid vascular injury, visualization of the tip of the block needle, and appropriate deposition of local anesthetics. The use of the nerve stimulators adds safety margins during nerve blocks.

Conclusion

The understanding of the surface landmarks, regional and sonoanatomy are key to the successful nerve blocks. Identification of inferior gluteal artery can help proximal localization of the sciatic nerve, as soon as both the nerve and the artery emerge in inferior GSF.

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Special Article

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A Decade of Critical Care Medicine in Nepal: Where Have We Reached?

Subhash P Acharya[1], Kabita Sitoula[1], Hem Raj Paneru[1], Shital Adhikary[2]

[1] Department of Critical Care Medicine, Maharajgunj Medical Campus, IOM, TUTH, Maharajgunj, Kathmandu, Nepal.
[2] Department of Pulmonology and Critical Care, Chitwan Medical College, Bharatpur, Chitwan, Nepal.

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Abstract

The first ICU in Nepal started in 1973 at Bir Hospital and now there are 1595 ICU beds in Nepal and 840 ICU Beds with ventilators but only 35 Intensivists and only 2.8 ICU Beds/100,000 population. Anesthesiologists are the main physicians working in ICU and almost all ICUs are open or semi closed. Society of Anesthesiologist of Nepal was established since November 1987 whereas after 2010 Nepalese Society of Critical Care Medicine was established. Nepal Critical Care Development Foundation was established in 2012 which started workshops & training for Nurses and also organizes various awareness programs on Sepsis Day and Hand Hygiene Day.

Critical Care Nurses Association of Nepal was established in 2016 and organizes CCN instructor training program and also critical care nurse training program that has certified more than 300 Critical Care Nurses.

Doctorate of Medicine in Critical Care Medicine was started at Institute of Medicine, Tribhuvan University as the first academic program in CCM from 2013 after which fellowship in CCM was started at National Academy of Medical Sciences (2020) and by NSCCM (2023).Masters in Nursing in Critical Care has been started from 2023 at Maharajgunj Nursing Campus, Institute of Medicine from 2023.

Nepal Intensive Care Research Foundation was established in 2020 and started ICU Registry which is now running in 19 ICUs and also working in research and clinical trials.

Although COVID has brought in huge investment in infrastructure and equipments, the parallel growth in trained human resources and implementation of standard of care is still awaited. The current need of Critical Care in Nepal is trained human resources, more resources in clinical research, patient safety and quality.

First ICU in Nepal: Fifty years ago

The first ICU in Nepal started in 1973 at Bir Hospital as a five-bed medical ICU by King Mahendra who returned from Delhi after receiving treatment for some heart problem where he realized the need of ICU in Nepal.[1,2] Ms. Rameshwori Shrestha, was known as the First ICU Nurse who worked in this ICU at Bir Hospital.[3] This was the only ICU in the country for almost 20 years till 1992 when six bed mixed medical surgical ICU (TUTH ICU) and five 5 bed Coronary ICU (CCU) and additional 10 beds of high dependency units-Intermediate Cardiac Care Unit (ICCU) and Surgical ICU (SICU) was started at Tribhuvan University Teaching Hospital at Institute of Medicine (IOM). After this, slowly other ICUs started to arise and reached to current state[1,2] In Nepal, Anesthesiologists were and still are the main physicians working in ICU along with other specialist as Society of Anesthesiologist of Nepal (SAN) was established since November 1987 and have been

Correspondence:
Subhash P Acharya, Department of Critical Care Medicine, Maharajgunj Medical Campus, IOM, TUTH, Maharajgunj, Kathmandu, Nepal.
Email: drsuvash@gmail.com

working in developing anesthesia, critical care and pain medicine services and education in the country.[4]

Nepalese Society of Critical Care Medicine (NSCCM)

Under the leadership of founding president, Prof. Dr. Moda Nath Marhatta, NSCCM was established on 10 April 2010 with members from Anesthesiology, Internal Medicine, Cardiology – whoever was working in ICU as there were no trained Intensivist in the country. NSCCM also became a member of WFSICCM in 2018 and currently there are 160+ Life Members including Intensivist, Internists and Anesthesiologists. NSCCM has been organizing CME every month and organized its first conference in 2014 and since then in 2016, 2018 and in 2022 organized twenty second Asia Pacific Association of CCM (APACCM) Conferences in Nepal which was a massive event in Nepal as there were 700+ participants.[2,5]

NSCCM also published NSCCM ICU Protocols in 2018 to start with basic management in ICU including Care Bundles (VAP, CAUTI, CLABSI), Vasopressors, Sedation, Analgesia, Glucose Control, Electrolyte Replacement, ABCDE, DVT, SUP, etc. and also recently published its second edition in December 2023.[6]

NSCCM is also organizing BASIC ICU course from 2014 which is a two days workshop from the BASIC Group from the Chinese University of Hong Kong (CUHK) and is usually for doctors and senior nurses. NSCCM has also endorsed Acute Care USG workshop since 2015 which is one day for doctors working in ICU.[6]

NSCCM also endorses few other workshops including CPR (2016), Beyond BASIC Airway Management (2017), Basics of Mechanical Ventilation (2022), Critical Care Nutrition (2022).

NSCCM has also been working in close collaboration with critical care societies from India (ISCCM) and other SAARC countries and also member of regional collaborations including Association of SAARC Critical Care Societies (ASAARCCS) and Asia Pacific Association of Critical Care Medicine (APACCM).[6]

Nepal Critical Care Development Foundation (NCCDF)

NCCDF was established in 2012 as not for profit, charitable organization.[7] The main objectives of NCCDF were education and training of Nurses in ICU as there were very limited trainings for nurses working in ICU before that time. NCCDF started with BASIC for Nurses (CUHK) course which is a two-day course for fresh nurses since 2016 and then running other workshops including CPR for Nurses (2018), VAP Prevention (2018), Tracheostomy Care (2019) & Infection Prevention and Control (2017) workshops. These workshops are endorsed by Critical Care Nurses Association of Nepal (CCNAN) and are very low-cost, organized and managed independently by Nurses and has proven to be an example of self-sustainability and empowerment of nurses. NCCDF also manages poor patient funds and also organizes programs for awareness of public in Sepsis Day (13 September) with events like Sepsis Walk, Sepsis Rally, Inter-ICU Sepsis Quiz and Hand Hygiene Campaign (5 May) every year. NCCDF also supports nurses to attend international conferences and meetings so that critical care nurses of Nepal could get the opportunity to present at various international platforms.[5,7]

Critical Care Nurses Association of Nepal (CCNAN)

With increasing number of ICUs and nurses working in Critical Care, a need for professional organization was felt and Critical Care Nurses Association of Nepal (CCNAN) was established in 2016 and started with 40+ nurses and have now reached to 200+ life members.[8] All nurses working in Level III ICU for at least one year or have certification in Critical Care Nursing can become life member of CCNAN. In 2017, CCNAN also started the first Instructor training (Critical Care Nurse Instructor Training Program) which was a six-month course equivalent to post graduate diploma which graduated 20 Instructors and these instructors became the one to teach and certify nurses with three-month critical care nurse training program (CCNTP) which has been conducted almost for 14 batches across the country since 2017 and graduated 300 + certified critical care nurses in the country. CCNAN also organized the First International CCN Conference in Kathmandu in November 2017 and also established the Regional Federation of CCN of SAARC (RFCCN-SAARC). India became the first president of RFCCN SAARC and organized a conference in Belgaum, Bengaluru in 2018 and again in 2019, Second Conference of RFCCN-SAARC was organized in Butwal, Nepal and the presidency of RFCCN-SAARC was handed over to Nepal.[3] Since then, Ms. Laxmi KC and Ms. Kabita Sitoula are the current president and general secretary of RFCCN-SAARC respectively. CCNAN was also able to send its representative to attend the world congress in Sydney, Australia in 2019.[8]

Academic Programs in CCM in Nepal

Before 2013, there were no academic training programs in Nepal and so one had to go abroad to get trained in CCM. But in 2013, the first DM Critical Care Medicine (DM CCM) was started at Maharajgunj Medical Campus, Institute of Medicine, Tribhuvan University, in support and collaboration with Royal College of Canada International (RCCI, RCPSC) with great efforts from Dr. Laura Hawryluck, Dr. Redouane Bouali and Dr. Susan Brien. Till now there are four other institutions running DM CCM with around ten seats in 2022 but only five residents enrolled in the program.

National Board of Medical Specialties (NBMS) have been established under the Medical Education Commission (MEC) as per the Act from Parliament of Nepal and have started National Board Fellowship in CCM which is a three-year course and have recruited one student every year from 2021.[10] Also, there has been a one-year clinical fellowship in CCM running at National Academy of Medical Sciences (NAMS) from 2020.

NSCCM has now established National Institute of Critical

Care Medicine (NICCM) in 2023 which has started a one-year long clinical fellowship in adult critical care from 1st January 2023 at three hospitals, Birat Nursing Home (Biratnagar), B & B Hospital (Kathmandu) and Manipal Teaching Hospital (Pokhara). This fellowship is focused to develop training programs and give opportunities for MD graduates to stay in their hometown and pursue their clinical career outside Kathmandu, which has been portrayed in various social media platforms as Master of Nursing Critical Care Outside Kathmandu (#CCOK).[6]

In Nursing, Masters in Critical Care Nursing has been started from 2023 at Maharajgunj Nursing Campus, Institute of Medicine, Tribhuvan University which is a two-year academic program to develop academic leadership in CCN and now has been extended to three institutions in the country, MNC, NAMS and Chitwan Medical College.[9]

Critical Care Services

Considering Clinical Services, Government of Nepal published Guidelines in 2014 and mentioned that of the total hospital beds, at least 5 percent should be the ICU beds, with one ventilator for two ICU beds (50%), nurse to patient ratio of 1:1 and separate isolation bed for patients with severe infectious disease. But, most of the government hospitals do not meet these criteria. Even the largest University hospital, Tribhuvan University Teaching hospital has less than 50 percent of the required critical care beds, and Nurse: Patient ratio of 1:2 to 1:3. Moreover, we do not have the exact statistics of the current status of ICUs across the country.[10]

As per survey done by NSCCM at the onset of COVID, there were total of 480 ICU beds in the country with around 260 ventilators. Government-owned hospitals had 150 ICU beds and Majority of these ICU beds were level I or level II and very few hospitals provide level III care. There were 800 Critical Care Nurses who were experienced (>1year in ICU) or Trained/Certified Critical Care Nurses (250+). There were only few hospitals which had Intensivist as head of ICU, In House coverage by consultant (MD) and very rare to have intensivist in Government Hospitals.[11] In another study by Neopane et. al., there were total 194 Hospitals with ICUs and total 1595 ICU beds in the country and 840 ICU Beds with ventilators. There was total 25 Intensivists in the country and 2.8 Beds/100,000 population.[11,12] But after COVID, government of Nepal have added around 200 Level III ICU Beds and another 600 HDU beds across many public hospitals in the country.

By the end of December 2023, there are only around thirty-seven critical care physicians in Nepal out of which around ten have done their Doctorate of Medicine (DM) in CCM, another ten did Fellowship in CCM from India, around ten from Toronto, Canada and few others from different countries.

Considering additional services, ECMO services started in the country at 2008 at Sahid Gangalal National Heart Center for Cardiac Surgical patients while it was started in TUTH in 2017 for primary respiratory failure. Liver transplant ICU was also started for the first time in TUTH in 2019. Deceased donation transplantation has started at Human Organ Transplant Center (HOTC) from 2017 for kidney and in 2023 for both kidney and liver.[13]

Research – Nepal Intensive Care Research Foundation (NICRF)

Research in Critical Care was in preliminary stages till 2019 but with the establishment of NICRF in 2020, which focuses on Collaborative Research, Nepal has been able to be involved in various multinational randomized trials including REMAP-CAP and MEGA-ROX.[14] With the permission from National Health Research Center, NICRF established ICU Registry in 2019 and have enrolled more than nineteen ICUs of Nepal. The ICU registry, headed by Dr. Diptesh Aryal has provided a platform for multicentric, International Clinical Trials. Under the leadership of Dr. Diptesh Aryal and Dr. Hem Raj Paneru, NICRF is working to develop various education and training in research in critical care and critical care nursing.[14,15] Several good publications have been published utilizing the deidentified patient data from the registry.[16,17,18,19]

Current Challenges

The most common challenge faced in Nepal now is gaps in human resources, epidemiological data with ICU Capacity and a huge gap in implementation of standards of care. Our ICUs are also struggling for allied health care workers and require epidemiological data and publications which are very few.[20] Also, there are huge gaps in allocation of resources as access to ICU beds is difficult outside major cities and still based on affordability and personal connections.

Conclusion

Though Nepal has a very short history in CCM, there has been substantial growth in various aspects of critical care medicine in the last decade including service, education and trainings. With the advent of COVID, huge investment in infrastructure and equipment in ICU was done by government and other donors, but focusing on development of human resources in Critical Care and allied health care forces, more investment in clinical research, and efforts toward Patient Safety and Quality shall be the prime target for the coming decades.

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