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Original Research Article

Comparative Study between Combined Sciatic-Femoral Nerve Block and Subarachnoid Block in Lower Limbs Surgeries

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Abstract:

Background: Subarachnoid blocks are the most popular method of administering regional aesthetic for procedures involving the knee and lower extremities. The possible benefits of a combined sciatic-femoral nerve block, however, make it an alternative that deserves investigation.

Methods: Fourty adult patients, ranging in age from 18 to 65, who were scheduled for knee or below knee surgery were randomly assigned to either Group A (which involved a subarachnoid block) or Group B (which involved a combination sciatic-femoral nerve block). Contrasted with Group A's 12 mg of 0.5% hyperbaric bupivacaine, Group B's sciatic and femoral blocks were each administered 20 and 30 ml of 0.5% ropivacaine, respectively.

Results: Compared to the separate sciatic and femoral groups, those undergoing combined preparation and preparedness for surgery took substantially longer. The subarachnoid group achieved a perfect block rate of 100%, but the sciatic-femoral group achieved an impressive 80% success rate. Statistical analysis revealed that the subarachnoid group had higher pulse rate and significantly lower systolic and diastolic blood pressures before to surgery. Within the first day following surgery, the combined sciatic-femoral group needed less analgesic overall and less analgesic duration.

Conclusion: Both methods were problem-free. Although the combined sciatic-femoral block had a slightly lower success rate than the subarachnoid block, it had benefitted such as longer analgesia and less need for postoperative analgesics. Success rates and postoperative analgesic results should be considered while choosing between these approaches.

Keywords: Regional anaesthesia, subarachnoid block, combined sciatic-femoral nerve block, Knee surgery, below knee surgery, hyperbaric bupivacaine, Ropivacaine.

Introduction

Regional block anaesthesia is appropriate for life-saving treatments when central neuraxial and general anaesthesia are risky, requiring no fasting, preparation, or optimization.[1] Subarachnoid (spinal) blocks are safe and effective alternatives to general anaesthesia for the lower body, perineum, and extremity surgery.

Due to the toxicity of sizeable local anaesthetic doses and the difficulty of finding the epidural space, spinal anaesthesia was the standard for neuraxial anaesthesia throughout the 20th century. Only a subarachnoid block can provide anaesthesia [2]. The third is serious muscular and sensory paralysis and pain perception, which are side effects of spinal anaesthesia.

Spinal anaesthesia injects medicines into CSF, not the dura mater like epidural anaesthesia. The sensorimotor block is denser and requires less local anaesthetic. Peripheral nerve blocks provide surgical anaesthesia with better cardiorespiratory stability than central neuraxial blockade, which might produce hypotension, bradycardia, meningitis, post-dural puncture headache, hematoma, neurological impairment, etc [4].[5] Ultrasound and peripheral nerve stimulators have made peripheral nerve blocks the preferred anaesthetic for isolated limb procedures, replacing G.A. and central neuraxial blockade.[6] Despite its evident benefits, a 3:1 sciatic-femoral nerve block is one of the most underutilized lower limb anaesthetic treatments. Two blocks use huge volumes, so remember the maximum drug dose [7]. Given the preceding, we compared two anaesthetic methods: a combination sciatic-femoral nerve block and a subarachnoid block. We also assessed how long and well the discomfort was handled in the first several days after surgery.

Aims and Objective

- To monitor intraoperative and postoperative hemodynamic changes and problems.
- To track how long it takes for patients to feel better after surgery and when they need to take their first pain medication.

Anatomy

Spinal Anatomy and Anaesthesia

The spinal cord stops at L2 after originating at the brainstem and travelling through the spinal canal. A plexus origin causes cervical and lumbar enlargements. The dura, pia, and arachnoid mater comprise the subarachnoid space, which contains cerebrospinal fluid, and meninges enclose the spinal cord. From spinal column level 4 to 3, the sciatic nerve, the body's biggest nerve, serves the lower extremities. This tissue is crucial for sensory and motor activities because it branches into the tibial and common peroneal nerves. The doctor uses sterile drapes, local anaesthetics, and needles to give lumbar spinal anaesthesia [8]. Squatting is used to reach the L3/4 or L4/5 interspace during surgery. Non-umbilical surgeries are indicated. However, infections and high intracranial pressure are contraindications.

Neuraxial Anaesthesia

Careful patient placement and access site identification are critical components of neuraxial anaesthesia, which is necessary for various operations. With extreme caution and asepsis, a paramedian or midline route is selected. Back pain and headache after a spinal puncture are unusual but possible complications. Better pain control, less opioid use, and faster recovery are all advantages of neuraxial anaesthesia [9].

Sciatic Nerve Block

Using ultrasound guidance, the sciatic nerve—essential for the function of the lower limbs—can be blocked at several anatomical sites. Sacroiliac, transgluteal, subgluteal, anterior, and popliteal approaches are among those that can be used. Postoperative motor considerations, surgical site, and tourniquet placement are some factors that influence the choice of method.

Clinical Significance

The use of neuraxial anaesthesia allows for awake surgeries, such as cesarean sections, which promote bonding between the mother and newborn right away. Furthermore, it is an adjunct to general anaesthesia for the management of pain following a thoracotomy [10]. When planning a sciatic nerve block, it is essential to consider the patient's position and any risks involved. This method provides good pain relief for the lower limbs during various procedures.

Pharmacology

The local anaesthetic bupivacaine, brand name Marcaine, is used for pain control, epidurals, nerve blocks, and other similar procedures. Epinephrine can lengthen its endurance, but it comes with a host of adverse effects, including drowsiness and changes in vision. There are inconsistencies, especially when it comes to hypersensitive reactions [11].

Medical Uses

Local infiltration, nerve blocks, and epidurals are among the operations that call for bupivacaine. Pain alleviation is improved using liposomal formulations such as EXPAREL. Specific postoperative uses have led to the approval of implantable versions like Xaracoll.

Contraindications and Adverse Effects

Possible hazards are brought to light by specific contraindications, such as obstetrical paracervical blocks and joint injections. Very uncommon adverse events include the central nervous system and the cardiovascular system [12]. Injecting the wrong substance into an IV accidentally can kill. Ropivacaine is less harmful to the heart and is a safer option.

Pain Management and Sedation

Bupivacaine is an essential tool for pain control. Levels of sedation can be adjusted from very light to full-blown anaesthesia. Aside from drowsiness, medications provide anxiolysis, forgetfulness, and pain relief. People react differently. Thus, it's essential to use the right equipment and dose correctly.

Systemic Responses to Pain

Acute pain can affect many systems, including the immunological, cardiovascular, gastrointestinal, urinary, endocrine, and haematological systems. Neuroendocrine alterations impacting sleep, emotions, hunger, and social interactions may be a consequence of chronic pain, on the other hand [13].

Pain and Sedation

Pain measurement

To quantify an intangible quality or attitude that is thought to lay on a spectrum of possible values, researchers have developed the Visual Analogue Scale (VAS). It is commonly employed in clinical and epidemiologic studies to quantify the occurrence or severity of specific symptoms. For instance, there is a continuum from zero to extremely high levels of discomfort that a patient may experience. The patient perceives this spectrum as continuous since their pain does not vary in intensity, unlike what would be implied by a classification of none, mild, moderate, and severe. The same idea of an underlying continuum inspired the creation of the VAS [14]. The VAS is straightforward, efficient, and minimally intrusive compared to other dependable approaches.

Sedation: A sedation therapy regimen's primary objectives are the efficient management of pain, anxiety, and sleep (hypnosis). 44 Grading systems for sedation - The development of numerous trustworthy rating scales has enhanced the administration of sedation. A few of the most used scoring systems include the Motor Activity Assessment Scale (MAAS), the Riker Sedation-Agitation scale (S.A.S.), and the Ramsay score. On the 6-point Ramsay scale, 1 indicates extreme anxiety and 6 shows a complete lack of response. Since its inception in 1974, this scale has become one of the most popular and reliable options.

Ramsay Sedation Scale

Score	Response
1	**Anxious and agitated or restless or both**
2	**Cooperative, oriented and tranquil**
3	**Responding to commands only**
4	**Brisk response to light glabellar tap**
5	**Sluggish response to light glabellar tap**
6	**No response to light glabellar tap**

Technique of Relevant Blocks

Subarachnoid Block Technique

Selecting the proper medication and needle is an essential part of getting ready for spinal anaesthesia. To lessen the likelihood of headaches following a spinal puncture, a 25-gauge Quincke needle was selected. Patients can be placed in lateral decubitus, sitting, or prone, depending on the situation. To ensure the most effective delivery of spinal anaesthetic, the midline or paramedian puncture technique requires meticulous projection and penetration stages to reach the subarachnoid and epidural areas.

Combined Sciatic-Femoral Nerve Block Technique

Sciatic Nerve Block

The preferred method is the Labat trans gluteal technique, which involves placing the patient in a lateral posture. When performing procedures below the knee, the method seeks to obstruct the sciatic nerve by determining needle entrance positions about anatomical markers [15].

Femoral Nerve Block

When the patient is lying on their back, the inguinal ligament is the focus of the femoral nerve block. The correct placement is guaranteed by stimulating a pulse or motor response while a 22-gauge needle is advanced laterally. With a nerve stimulator, you can put the hand exactly where it needs to be without the patient lifting a finger.

Advantages of Nerve Stimulator

Nerve stimulators improve placement accuracy and make patients more comfortable by avoiding the need to trigger paresthesia. Adjusting the stimulating current, establishing the stimulus frequency, and watching muscle contractions for accurate needle placement are all practical issues when using a nerve stimulator.

Review of Literature

Regional anaesthetic has its roots in the first subarachnoid block, which was carried out by [16] using a cocaine solution. Concerns about toxicity and improvements in general anaesthesia caused spinal procedures to diminish from the 1930s to the 1950s. Another factor that hindered the widespread use of intradural spinal analgesia was the fear of litigation.

Injecting cocaine into nerve trunks dates back to the 1880s when [17] are credited with developing peripheral nerve blocks. The advancement of regional anaesthesia techniques was hastened by Gaston Labat's 1924 work at the Mayo Clinic. Subarachnoid anaesthesia has been popular again since the 1960s and is currently used often in therapeutic settings. On the first day following a total knee replacement, [18] found that the group with a combination continuous sciatic-femoral nerve block had a substantially decreased incidence of side effects compared to the group receiving epidural analgesia. Recent research has also looked into continuous sciatic-femoral nerve blocks and how they work better than standard analgesics for postoperative pain control with fewer side effects. [19] Have looked into the use of ultrasound-assisted femoral nerve blocks for total knee arthroplasty, and they found that they provide effective pain relief with few adverse effects.

Materials and Methods

Regional anaesthesia for lower limb surgery: A comparison between subarachnoid block and combination Sciatic-Femoral nerve block was conducted at M.G.M. Medical College and L.S.K. Hospital, Kishanganj, Bihar. We made sure to get ethical approval and informed permission from every participant.

Patient Criteria: Forty patients for knee or below-knee surgery who were between the ages of 18 and 65 and had an A.S.A. physical status of 1 or 2 were included in the study. Refusal to undergo regional anaesthesia, allergy to a local anaesthetic, an A.S.A. physical status more significant than 3, problems with positioning, diabetes, elevated intracranial pressure, neurologic illnesses, coagulopathy, infections, severe hypovolemia, continuous analgesic treatment, and so on were all considered exclusion criteria.

Preoperative Assessment: Comprehensive medical histories, physical exams, and diagnostic tests were all conducted on patients. A battery of tests, including an electrocardiogram (E.C.G.), blood sugar, urea, creatinine, and haemoglobin levels, were performed before surgery.

Anaesthesia Techniques: A subarachnoid block (Group A) and a combined sciatic-femoral nerve block (Group B) were administered to patients at random. The combination nerve block used ropivacaine guided by a nerve stimulator, whereas the subarachnoid block included dural puncture with hyperbaric bupivacaine.

Monitoring and Management: Electrocardiograms, non-invasive blood pressure measurements, and pulse oximetry were the standard techniques for monitoring. At predetermined intervals, hemodynamic variables were measured. Fluid resuscitation and medicines were used to address bradycardia and hypotension.

Assessment Parameters: Topics covered in the study were time spent preparing for surgery, surgical preparedness, nerve block quality, length of sensory loss, postoperative pain (as measured by VAS), need for tramadol, and adverse events.

Statistical Methods:

The statistical analysis included mathematics, standard deviation, standard error, and a significant Z-test. A significance level of 5% was determined. This study aims to help improve regional anaesthetics by shedding light on the relative merits of subarachnoid block and combined sciatic-femoral nerve block in the context of lower limb procedures and their respective risks and benefits.

Results and Analysis

Table 1: Distribution of patients according to age, sex and body weight (n1= 20, n2= 20)

		Group A	Group B
Sex	Male	12	11
	Female	8	9
Age (yrs)	Range	24-60	20-64
	Mean	41.8	40.4
	SD	8.92	10.77
Weight (kg)	Range	50-70	50-70
	Mean	60.32	59.28
	SD	5.13	5.33

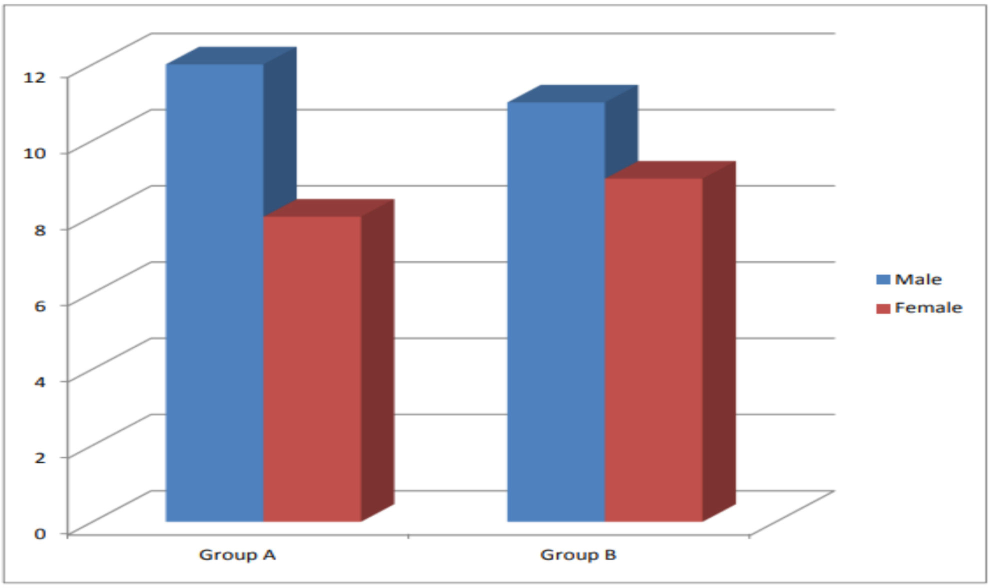

Chart 1: Sex Distribution of patients

Table 2: Distribution of surgical procedures performed in the two groups (n1= 20, n2= 20)

Type of Surgery	Group A	Group B	Total
Orthopaedics	16	16	32
Plastic surgery	4	4	8
total	20	20	40

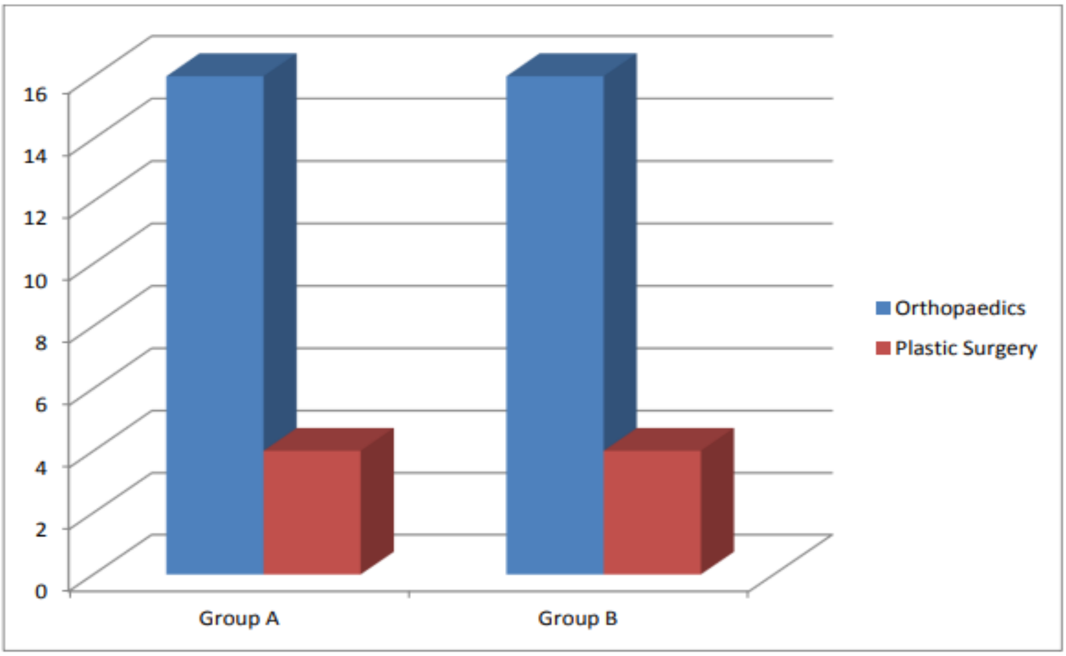

Chart 2: Distribution of surgical procedures performed in the two groups

Table 3: Distribution of study population according to A.S.A. status (n1= 20, n2= 20)

	Group A	Group B	Total
ASA 1	16	15	31
ASA 2	4	5	19
total	20	20	40

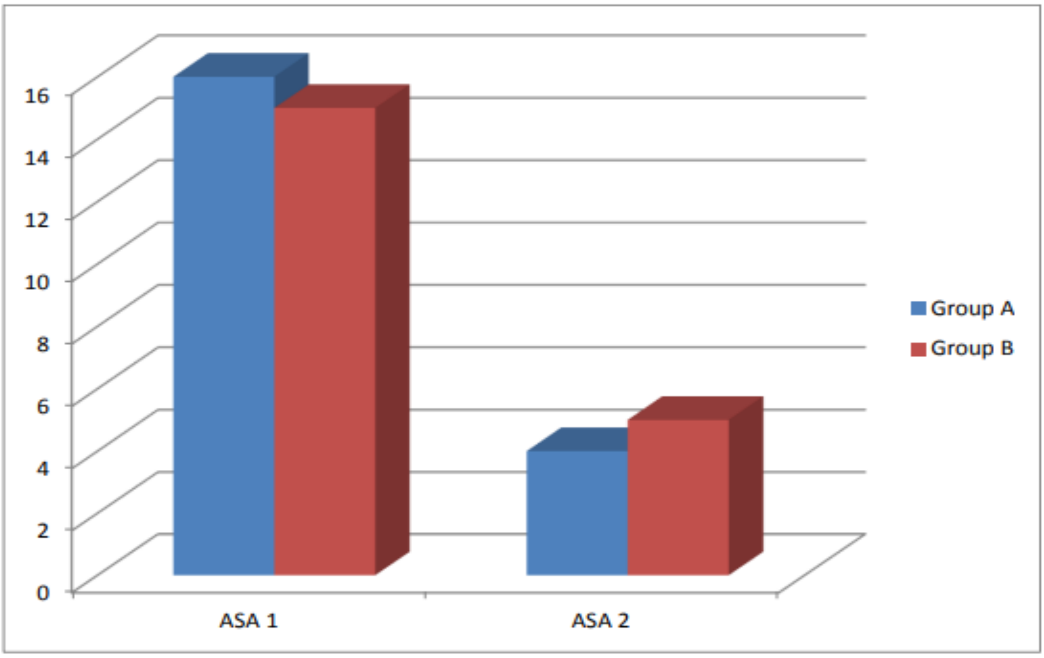

Chart 3: Distribution of study population according to A.S.A. status

Table 4: Distribution of duration of surgery in the two groups (n1= 20, n2= 20)

Duration of surgery (min)	Group A	Group B
Range	60-150	60-150
Mean	89.4	90
SD	26.86	27.96

Table 5: Distribution of pulse rate at regular intervals after block (n1= 20, n2= 20)

Pulse at min	Group A				Group B			
	Total	Mean	Variance	SD	Total	Mean	Variance	SD
01914	1914	76.56	10.08	3.24	1520	76	23.30	4.95
52032	2032	81.08	11.80	33.51	1529	76.45	23.74	4.99
102178	2178	87.12	10.26	3.27	1530	76.50	18.55	4.41
152204	2204	88.16	15.65	4.03	1520	76	15.90	4.09
300212151	2151	86.04	14.59	3.89	1523	76.15	21.02	4.70
452109	2109	84.36	11.27	3.42	1526	76.30	22.71	4.88
602065	2065	82.60	12.16	3.55	1519	75.95	20.94	4.69
751553	1553	81.74	13.56	3.78	1147	76.47	20.51	4.68
901047	1047	80.53	14.71	3.99	846	76.90	21.35	4.84
105656	656	82	6.75	2.77	471	78.50	21.25	5.04
120412	412	82.40	3.44	2.07	308	77	19	5.03
150162	162	81	9	4.24	144	72	4	2.82

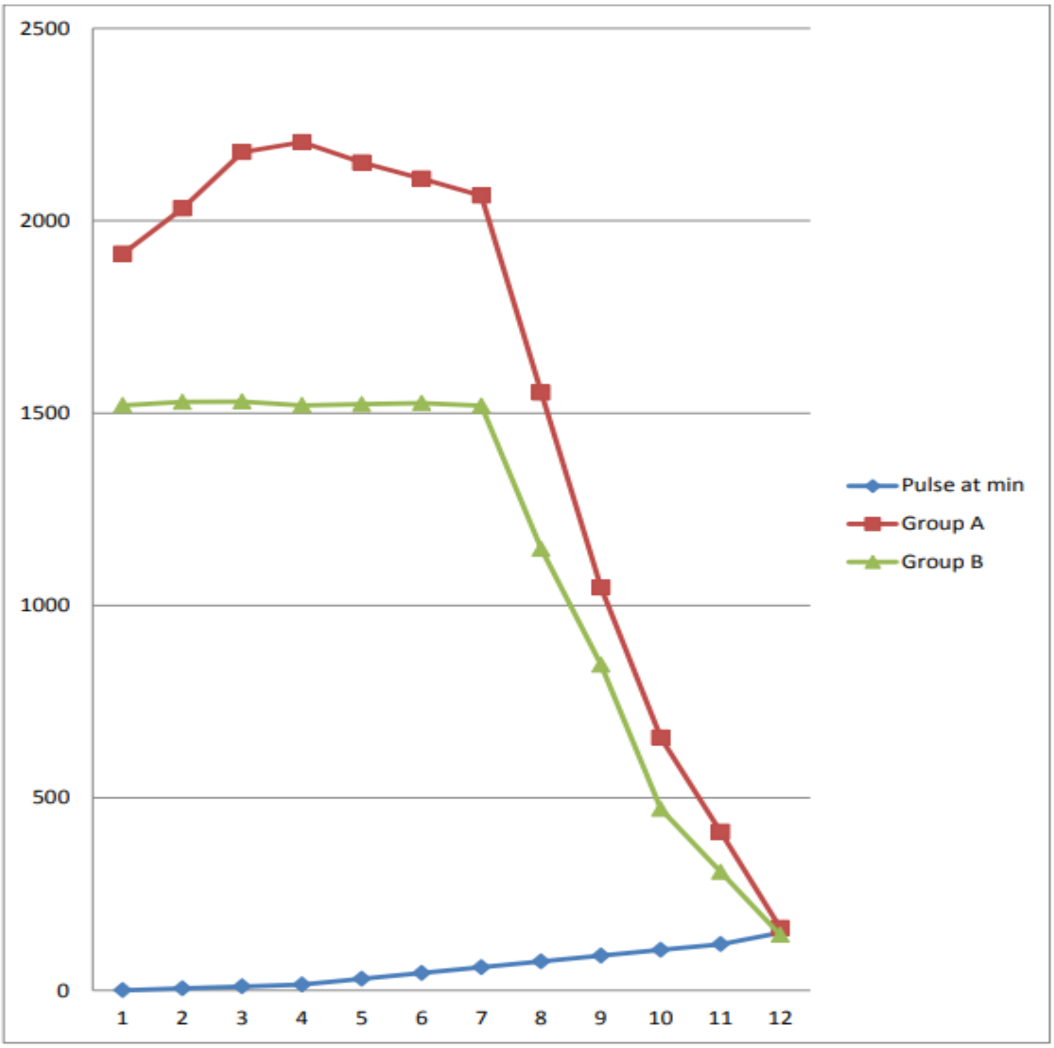

Chart 4: Distribution of pulse rate at regular intervals after block

Table 6: Distribution of systolic blood pressure at regular intervals after block (n1= 20, n2= 20)

SBP at min	Group A				Group B				p value for mean SBPs
	Total	Mean	Variance	SD	Total	Mean	Variance	SD	
0	3142	125.6	74.89	8.65	2550	127.5	83.73	9.15	0.498
	2874	114.9	60.04	7.74	2538	126.9	64.62	8.03	<.00001
10	2568	102.7	43.62	6.6	2538	126.9	84.41	9.18	<.00001
15	2422	96.88	49.02	7	2560	128	69.05	8.3	<.00001
30	2656	106.2	52.1	7.21	2550	127.5	92.57	9.62	<.00001
45	2922	116.8	45.69	6.75	2554	127.7	96.11	9.8	0.0001
60	3040	121.6	52.66	7.25	2554	127.7	84.32	9.18	0.0167
75	2326	122.4	51.81	7.19	1906	127.1	87.92	9.37	0.1117
90	1616	124.3	61.23	7.82	1392	126.6	109.6	10.47	0.5555
105	960	120	40	6.32	788	131.3	52.26	7.22	0.0088
120	602	120.4	4.8	2.19	538	134.5	41	6.4	0.0023
150	240	120	0	0	282	141	2	1.41	0.0023

Table 7: Distribution of diastolic blood pressure at regular intervals after block in two groups (n1= 20, n2= 20)

DBP at min	Group A				Group B				p value for mean DBP
	Total	Mean	Variance	SD	Total	Mean	Variance	SD	
0	2072	82.88	41.02	6.4	1688	84.4	35.62	5.96	0.4195
5	1880	75.2	34.33	5.86	1678	83.9	33.04	5.74	<.00001
10	1710	68.4	26	5.09	1680	84	36.63	6.05	<.00001
15	1576	63.04	20.04	4.47	1680	84	34.52	5.87	<.00001
30	1758	70.32	34.56	5.87	1664	83.2	42.69	6.53	<.00001
45	1948	77.92	35.82	5.98	1688	84.4	41.09	6.41	0.0011
60	2012	80.48	45.09	6.71	1694	84.7	40.95	6.39	0.0382
75	1562	82.1	43.06	6.56	1250	83.33	39.8	6.3	0.6179
90	1074	82.61	42.25	6.5	912	82.9	32.29	5.68	0.9081
105	632	79	30.85	5.55	514	85.66	21.46	4.63	0.0349
120	404	80.8	3.2	1.78	350	87.5	9	3	0.0041
150	16	80	0	0	178	89	2	1.41	0.0121

Table 8: Distribution of study population according to the adequacy of the block between the two groups (n1= 20, n2= 20)

	Group A N1	Group B N2
Adequate Block	20	16
Inadequate Block	0	3
Failed Block	0	1
Total	20	20

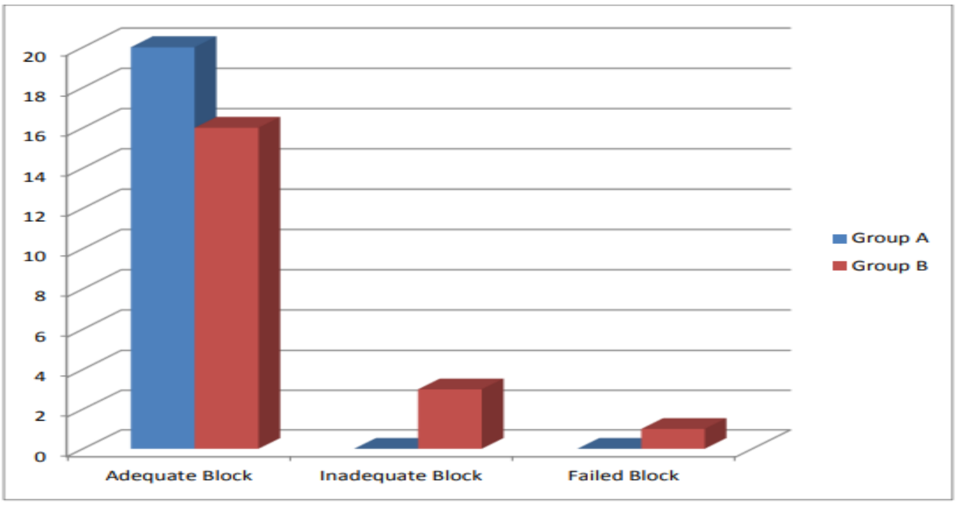

Chart 5: Distribution of study population according to the adequacy of the block between the two group

Table 9: Comparison of duration (min.) of analgesia between the two groups (n1= 20, n2= 20)

	Group A N1	Group B N2
Range	178-230	251-330
Mean	198.64	290.25
SD	14.11	14.12

T Statistic =18.7433, P-value

Table 10: Comparison of total rescue analgesics (mg.) in the 1st 24 hr postoperative period between the two groups (n1= 20, n2= 20)

	Group A N1	Group B N2
Range	250-350	150-250
Mean	298	212.5
SD	33.78	35.81

T Statistic =8.2133, P-value

Discussion

Regional anaesthesia is better than general anaesthesia for surgeries below the knee or thigh. This study examines whether combined sciatic-femoral nerve block could replace subarachnoid block due to its alleged benefits, such as fewer cardiovascular changes. The study at M.G.M. Medical College and L.S.K. Hospital in Kishanganj recorded hemodynamic changes before and after surgery, complications, analgesic duration, and when patients needed them again. From May 2019 to June 2021, 40 persons who met the criteria participated in the trial. No age, weight, or sex difference existed between patient groups A and B. Group A had a subarachnoid block, while Group B received a sciatic-femoral nerve block. Familiarity with the subarachnoid block procedure produced a statistically significant difference in preparation time. Surgical anaesthesia began much faster with subarachnoid blocks. Subarachnoid nerve blocks were 100% successful. However, the combined group failed 20%. A transient pulse rate and systolic/diastolic blood pressure change were seen during hemodynamic comparisons. Subarachnoid block briefly raised the pulse rate, but both treatments attained hemodynamic stability. The study found that sciatic-femoral analgesia lasted longer and required fewer postoperative analgesics than subarachnoid block. Both groups had no serious issues. Due to their hemodynamic stability and sustained analgesic effects, combined sciatic-femoral blocks are helpful for knee or below-knee procedures despite their greater failure rate and lengthier preparation time.

Conclusion

The study found several essential things. First, the combined sciatic-femoral block takes longer to prepare for surgery than the subarachnoid block. Variation is due to diminishing familiarity with the combined approach and its technical difficulty. Second, the sciatic-femoral block has superior hemodynamic stability during surgery compared to the subarachnoid block. The combined technique is a promising alternative due to constant hemodynamics during surgery. Thirdly, the study found the sciatic-femoral block more effective than the subarachnoid block. The combination technique improves lower limb treatments overall. Postoperative results are better with the sciatic-femoral block than with the subarachnoid block. Longer-lasting analgesia reduces the demand for acute postoperative painkillers. The combo block extends the time until the first painkiller dose, which may improve pain control. The sciatic-femoral block has an 80% success rate compared to the subarachnoid block's 100%. Although there may be a more significant failure, the combined technique is still beneficial. Knowing neither operation is risky is good. In lower limb surgeries, no complications have been documented with subarachnoid and sciatic-femoral blocks.

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