The Egyptian Journal of Hospital Medicine (October 2023) Vol. 93, Page 7797-7802

US Guided Fascia Iliaca Block versus Femoral Nerve Block for Post Operative Analgesia for Patient Undergoing Total Knee Arthroplasty

Raouf Ramzy Gadalla; Reham Fathy Galal;
Nermeen Shawky Ahmed, Samuel Habachi Daniel
Department of Anaesthesiology, Intensive Care and Pain Management
Faculty of Medicine - Ain Shams University
Corresponding author: Samuel Habachi Daniel; **Tel. No.:** 01224394897; **E-Mail:** samuel_habachi@hotmail.com

ABSTRACT

Background: Pain is the leading cause that drives patients to receive total knee arthroplasty (TKA), it is also performed to improve joint mobility and quality of life. Peripheral nerve blocks with different modes have shown favorable control of perioperative pain associated with TKA. The development of new anesthetic medications has given more success in performing peripheral nerve blocks. **Aim of the Study:** To study the effect of fascia iliaca compartmental block in postoperative pain control in patients of TKA and comparing it to femoral nerve block.

Patients and methods: Seventy adults who were undergoing TKA were included in this prospective randomized clinical trial. Patients receiving spinal anaesthesia were randomly allocated to either have an ultrasound guided fascia iliaca compartment block (FICB) or femoral nerve block (FNB).

Results: Patients in FICB group had a statistically significant lower visual analogue scale score at PACU arrival than the FNB group with mean and standard deviation 1.00 ± 0.00 vs. 1.11 ± 0.32 respectively (p= 0.041). This was also seen after 6, 12 and 24 hours postoperatively. The time interval taken to ask for analgesia postoperatively was significantly later in FICB group than the other, with mean and standard deviation 9.86 ± 1.31 vs. 6.87 ± 0.92 respectively. There was also a significant decrease in total pethidine used in FICB patients.

Conclusion: The FICB can significantly decrease pain in the early postoperative period as well as after 6, 12 and 24 hours with a significant decrease in the usage of opioids.

Keywords: Fascia iliaca compartment block, peripheral nerve block, Total knee arthroplasty, Femoral nerve block.

INTRODUCTION

Patients with rheumatoid arthritis and advanced osteoarthritis commonly undergo total knee arthroplasty (TKA) to treat joint pain, which hinders mobility and worsens quality of life [(1)]. Unfortunately, thirty per cent of patients experience moderate postoperative pain, and to a greater extent of sixty percent, experience severe postoperative pain following total knee arthroplasty[(2)].

Early ambulation with regaining full range of motion is crucial in the recovery after TKA, and it also decreases thromboembolism. Postoperative pain hinders the previously mentioned ambulation and affects the patient's rehabilitation [(3)]. Consequently, in TKA patients, proper effective pain control is very crucial for early rehabilitation, which improves the patient's satisfaction [(4)]. Morphine and non-steroidal anti-inflammatory drugs (NSAIDs) may help in pain control in these patients. Fortunately, the outstanding performance of peripheral nerve blocks in decreasing pain intensity in the first twenty-four hours postoperatively and opioid usage has significantly decreased the hospital stay duration and improved the quality of life in TKA patients [(2)].

One analgesic method called the fascia iliaca compartment block (FICB) involves introduction of a local anaesthetic under the iliacus muscle's fascia [(4)]. The femoral nerve block which is used to anaesthetize the femoral nerve distribution during surgeries on the anterior thigh and knee, can encourage early hospital discharge and offer efficient pain control with minimal opioid usage, which subsequently lowers the drawbacks associated with consuming opioids [(5)]. In this study a randomized prospective clinical trial was done to study the effect of fascia iliaca compartment block (FICB) in management of pain in patients undergoing TKA, and to compare it to femoral nerve block (FNB).

PATIENTS AND METHODS

Over the course of six months (this prospective randomised clinical trial was performed in Ain Shams University Hospitals. In this study, seventy adult patients who were planned to undergo total knee arthroplasty (TKA) with spinal anaesthesia were randomly assigned, using opaque sealed envelopes and computer-generated codes, to one of the following groups: first group of patients (FICB) underwent an ultra-sound-guided fascia iliaca compartment block, and the second group of patients (FNB) underwent an ultra-sound-guided femoral nerve block.

Patients from both sexes with age range from 45-65 years, BMI: 28-32, Class- II and III of the American Society of Anaesthesiologists Physical Status (ASA), who were planned for Total knee arthroplasty (TKA) with spinal anaesthesia with time of surgery: 2-3 hours (hrs) were included in this study. Patients who had an allergic history to the drugs employed in the study, psychiatric illness, and complicated or redo knee replacement were excluded from the study. Also, patient refusal, coagulopathy, and local infection which preclude the use of regional anaesthesia were included in the exclusion criteria.

Prior to surgery, each patient was subjected to a complete physical examination, a thorough history

Received: 17/05/2023
Accepted: 18/07/2023

taking, and the needed investigations. Electrocardiography, pulse oximetry, and non-invasive blood pressure were connected as soon as the patients arrived in the operating room. An intravenous (IV) line was placed, and IV lactated Ringer was started. Baseline parameters such as systolic, diastolic and mean blood pressure were recorded every 15 minutes, along with heart rate and oxygen saturation (SpO_2).

Under completely aseptic conditions, a 25-gauge spinal needle was used to perform spinal anaesthesia for both groups. All subjects underwent spinal anaesthesia with 25 µg of fentanyl and 15–17 mg of hyperbaric 0.5% bupivacaine. Antiemetics were given intraoperatively. Using an ultrasound machine having a high frequency linear probe covered in a sterilized sheath (Sonoscape® SSI 6000, China, with high frequency linear probe (12 6 MHz)) and a 100 mm needle (B- Braun Medical Inc., Bethlehem, PA, USA), the femoral nerve block, or FICB, was carried out under strict aseptic precautions. FICB or femoral nerve block were performed in the study 15 min after spinal anaesthesia and time was recorded (Zero time)

In FICB group, the transducer was placed to determine the site of the fascia iliaca, the iliopsoas muscle and the femoral artery while the patient was lying supine during the block procedure. This was performed after sterilization of the skin. The transducer was shifted laterally until the sartorius muscle was seen. The needle tip was introduced between the fascia iliaca and the iliopsoas muscle using the in-plane technique. 30 millilitres of 0.25% bupivacaine were injected following negative aspiration, making sure not to exceed over the toxic dose of 3 mg/kg [(6)].

In femoral nerve block group, At the site of the inguinal ligament, the femoral artery and vein are situated medial to the femoral nerve. The femoral vessels were located by placing the transducer transversely at the inguinal crease. Sliding the probe proximally until only the common femoral artery and its corresponding femoral vein were visible would be necessary if there were multiple arteries seen (such as the superficial and deep femoral arteries). The classic appearance of the femoral nerve is an ovoid or hyperechoic wedge situated directly lateral to the femoral vessels. The femoral nerve is deep to the fascia iliaca and superficial to the iliopsoas muscle group [(7)].

Following identification of the femoral nerve and any important surrounding structures, a lidocaine wheal was carried out prior to the needle's introduction into the tissue, and the needle's tip was advanced beneath the fascia iliaca in the direction of the femoral nerve. To prevent intravascular injection, it was advised to confirm negative aspiration prior to injection. Thirty millilitres of 0.25% bupivacaine were injected, staying below the toxic dose of 3 mg/kg [(7)].

The local injection propagation around the nerve was visible on the ultrasound monitor. When administering an injection that causes unusually high injection pressure or nerve expansion, care must be taken as this could indicate intraneural injection [(8)].

Visual analogue scale (VAS), a subjective and validated pain measure for acute as well as chronic pain, was used to evaluate the patient's postoperative pain after the patient was released from the operating room. In order to record a score, a hand-written mark was placed on a 10 cm line, which signifies a continuum with "no pain" at the left side (0 cm) and "worst pain" at the right side (10 cm). After surgery, if VAS score was greater than three rescue analgesic was given (Paracetamol in the commercial form 1gm in 6 hrs interval if needed or Pethidine 25 mg in 6 hrs interval if needed).

Hypotension: defined as systolic blood pressure less than ninety mmHg, bradycardia: defined as heart rate less than fifty beats per minute, arrhythmia , vomiting, nausea, and other complications were noted as side effects. In response to bradycardia, atropine 0.5 mg was administered; to manage hypotension, 20 ml per kg of Ringer lactate was used. When the patient first arrived in the PACU, 30 minutes later, and then every hour if the patient stays there, the heart rate and mean blood pressure were measured. Vital signs (systolic, mean, diastolic blood pressure and heart rate) and pain intensity were measured in the surgical ward every two hours for the first six hours, and then every six hours for the following twenty-four hours after surgery. Ketolac 30 mg was given intravenous to each patient every 8 hours.

Ethical consideration:

The necessary approvals were received from the Anesthesia and Intensive Care Department and the Research Ethics Committee of the Faculty of Medicine of Ain Shams University. The Helsinki Declaration was strictly adhered to in the conduct of this study. Informed permissions were obtained from all patients prior to the commencement of the study.

Statistical analysis

The Statistical Package for the Social Sciences, version 21 (SPSS Inc., Chicago, Illinois, USA), was used to analyse the recorded data. Mean ±Standard deviation (SD) was used to represent quantitative data. Percentage and frequency were used to represent qualitative data. When analysing two means, the independent-samples t-test of significance was done. Whitney Mann U test: was used for two-group comparisons in non-parametric data. The comparison between qualitative data were analyzed using the Chi-square (X2) test. P value less than 0.05 was considered significant.

RESULTS

The studied patients were comparable in their demographic data of age, body mass index, sex, ASA classification and duration of operation in both studied groups as seen in table 1.

Table (1): Comparison of demographic data between FICB group and FNB group.

		Fascia iliaca compartment block group (FICB)	Femoral nerve block group (FNB)	Test value	P-value	Sig.
		No. = 35	No. = 35			
Age (years)	Mean ± SD	53.34 ± 6.27	55.23 ± 6.37	-1.249•	0.216	NS
Sex	Female Male	14 (40.0%) 21 (60.0%)	15 (42.9%) 20 (57.1%)	0.059*	0.808	NS
BMI	Mean ± SD	30.00 ± 1.48	29.80 ± 1.51	0.560•	0.577	NS
ASA	II III	29 (82.9%) 6 (17.1%)	27 (77.1%) 8 (22.9%)	0.357*	0.550	NS
Duration (min)	Mean ± SD	140.57 ± 15.04	140.00 ± 15.96	0.154•	0.878	NS

*: Chi-square test; •: Independent t-test, BMI=body mass index, Duration= duration of operation in minutes, SD= standard deviation, NS= non-significant, ASA= American Society of Anesthesiologists classification,

Heart rate was statistically significantly decreased in FICB group than FNB group at 4 hours to 24 hours postoperatively. Similarly, systolic blood pressure was significantly decreased in FICB group than FNB group at 6 hrs to 24 hrs postoperatively. Diastolic blood pressure was significantly decreased in FCIB group than FNB group at 6 to 24 hours (Tables 2, 3, and 4)

Table (2): Comparison of heart rate between FICB group and FNB group.

Heart rate (beat/min)		Fascia iliaca compartment block group (FICB)	Femoral nerve block group (FNB)	Test value•	P-value	Sig.
		No. = 35	No. = 35			
Baseline	Mean ± SD	93.97 ± 7.60	92.86 ± 6.06	0.678	0.500	NS
30 min	Mean ± SD	86.37 ± 6.37	86.94 ± 5.56	-0.400	0.690	NS
1hr	Mean ± SD	79.91 ± 5.14	80.09 ± 5.61	-0.133	0.894	NS
2hrs	Mean ± SD	73.89 ± 4.90	75.86 ± 4.62	-1.732	0.088	NS
4hrs	Mean ± SD	69.74 ± 4.99	81.09 ± 5.35	-9.168	<0.001	HS
6hrs	Mean ± SD	70.60 ± 3.80	91.20 ± 3.40	-23.901	<0.001	HS
12hrs	Mean ± SD	75.00 ± 4.20	95.14 ± 3.71	-21.259	<0.001	HS
24hrs	Mean ± SD	81.26 ± 4.88	99.91 ± 4.93	-15.915	<0.001	HS

•: Independent t-test min = minutes, hrs=hours, SD= standard deviation, NS= non-significant, HS= highly significant

Table (3): Comparison of systolic blood pressure between FICB group and FNB group

Systolic blood pressure (mmHg)		Fascia iliaca compartment block group (FICB)	Femoral nerve block group (FNB)	Test value•	P-value	Sig.
		No. = 35	No. = 35			
Baseline	Mean ± SD	131.69 ± 13.05	124.46 ± 14.58	2.186	0.032	S
30 min	Mean ± SD	104.71 ± 7.67	106.37 ± 12.13	-0.683	0.497	NS
1hr	Mean ± SD	106.20 ± 7.32	106.97 ± 13.20	-0.302	0.763	NS
2hrs	Mean ± SD	106.94 ± 7.67	108.37 ± 15.37	-0.492	0.624	NS
4hrs	Mean ± SD	107.43 ± 7.87	109.20 ± 16.18	-0.583	0.562	NS
6hrs	Mean ± SD	109.57 ± 6.63	125.49 ± 11.99	-6.872	0.000	HS
12hrs	Mean ± SD	118.34 ± 5.10	132.49 ± 10.93	-6.935	0.000	HS
24hrs	Mean ± SD	126.60 ± 4.40	139.29 ± 9.50	-7.166	0.000	HS

•: Independent t-test min = minutes, hrs=hours, SD= standard deviation, NS= non-significant, S= significant, HS= highly significant

Table (4): Comparison of diastolic blood pressure between FICB group and FNB group

Diastolic blood pressure (mmHg)		Fascia iliaca compartment block group (FICB)	Femoral nerve block group (FNB)	Test value•	P-value	Sig.
		No. = 35	No. = 35			
Baseline	Mean ± SD	87.29 ± 7.87	77.89 ± 10.74	4.178	0.000	HS
30 min	Mean ± SD	73.40 ± 3.66	73.94 ± 8.14	-0.360	0.720	NS
1hr	Mean ± SD	71.66 ± 4.35	69.51 ± 8.20	1.366	0.176	NS
2hrs	Mean ± SD	68.26 ± 5.20	65.94 ± 9.64	1.249	0.216	NS
4hrs	Mean ± SD	67.80 ± 5.43	69.51 ± 10.75	-0.842	0.403	NS
6hrs	Mean ± SD	69.43 ± 4.94	78.89 ± 7.88	-6.017	0.000	HS
12hrs	Mean ± SD	76.14 ± 4.84	84.17 ± 7.35	-5.395	0.000	HS
24hrs	Mean ± SD	82.54 ± 4.24	89.09 ± 7.22	-4.623	0.000	HS

•: Independent t-test min = minutes, hrs=hours, SD= standard deviation, NS= non-significant, S= significant, HS= highly significant

Visual analogue scale score was significantly decreased in early postoperative period in PACU in FICB group than FNB group and also at 6 to 24 hours postoperatively (Table 5).

Table (5): Comparison of VAS score between FICB group and FNB group

Visual analogue score (VAS)		Fascia iliaca compartment block group (FICB)	Femoral nerve block group (FNB)	Test value‡	P-value	Sig.
		No. = 35	No. = 35			
PACU	Mean ± SD	1.00 ± 0.00	1.11 ± 0.32	-2.045	0.041	S
2hrs	Mean ± SD	1.14 ± 0.36	1.17 ± 0.38	-0.326	0.744	NS
4hrs	Mean ± SD	1.20 ± 0.41	1.40 ± 0.50	-1.813	0.070	NS
6hrs	Mean ± SD	2.06 ± 0.48	2.31 ± 0.47	-2.136	0.033	S
12hrs	Mean ± SD	2.54 ± 0.70	3.11 ± 0.80	-2.971	0.003	HS
24hrs	Mean ± SD	2.77 ± 0.77	3.57 ± 0.92	-3.499	0.000	HS

‡: Mann Whitney test **PACU: post anesthesia care unit,** VAS= **Visual analogue score,** , hrs=hours, SD= standard deviation, NS= non-significant, S= significant, HS= highly significant

The time interval taken to first time to ask for analgesia postoperatively was significantly later in FICB group than FNB group. Total pethidine consumption was significantly decreased in FICB group than FNB group (Table 6).

Table (6): Comparison between FICB group and FNB group according to first time to ask for analgesia (hrs) and total pethidine consumption (mg) in 24 hours.

		Fascia iliaca compartment block group (FICB)	Femoral nerve block group (FNB)	Test value•	P-value	Sig.
		No. = 35	No. = 35			
1st rescue analgesia (hours)	Mean ± SD	9.86 ± 1.31	6.87 ± 0.92	11.045	<0.001	HS
Total Pethidine consumption (mg)	Mean ± SD	36.00 ± 11.62	67.86 ± 14.16	106.083^	<0.001	HS

•: Independent t-test, **^:** anova test HS= highly significant

DISCUSSION

Peripheral nerve blocks used have shown to be a significant benefit in perioperative pain management for patients undergoing TKA. The development of technology and anesthesia, along with the discovery of new and reliable anesthetic drugs, have led to an increased interest in peripheral nerve blocks. Along with general anesthesia, peripheral nerve

blocks are frequently used for control of postoperative pain. They can also be employed to anesthetize the operation area [9].

Additionally, peripheral nerve blocks can be utilized to enhance the effectiveness of analgesia. Thus, the stress response triggered by pain may decrease, the quality of recovery can increase and the duration of early rehabilitation and morbidity reduces. When IV patient-controlled analgesia and Peripheral nerve block were compared in terms of effectiveness on postoperative analgesia in a lower extremity surgery**,** peripheral nerve blocks were more efficient [10].

In the past, the FNB has shown to offer sufficient perioperative pain treatment and quick postoperative rehabilitation [11]. Furthermore, research has demonstrated that FNB offers comparable analgesia to epidural anesthesia with less risk of severe neuraxial compression than PCA-administered morphine [12,13].When used for TKA, FICB improves range of motion and reduces opioid demand in analgesia when compared to a placebo[14].

In order to determine whether ultrasound guided FI**C**B is more effective than FNB in terms of pain treatment, comfort, early mobility, and patient satisfaction, this exploratory study was carried out. Additionally, the postoperative VAS score, the amount of opioid (pethidine) administered in the first 24 hours, and the first time to rescue analgesia were measured and compared.

The effects FICB in the current study resulted in a decrease in the frequency and intensity of postoperative pain (as seen in the VAS score), which in turn reduced the need for opioids overall. According to the current study, FI**C**B was more effective than FNB. The first call for pain relief (pethidine), total use of opioids, and visual analogue scale (VAS) showed the superiority of FICB than the FNB technique. Compared to patients in group FICB, those in group FNB had significantly higher pain scores and were earlier to request analgesia; consequently, pethidine in the first 24 hours after surgery was consumed more.

The current study's findings are supported the findings made by **Kanadli and his colleagues** [15] who discovered that the FICB group's VAS level was considerably lower at the 24-hour mark than the FNB group's. The FNB group consumed less analgesics between the hours of 0 and 30 than the FICB group did; however, the FICB group's analgesic consumption was significantly lower during the 6-to-24-hour period than the FNB group's. FNB was more effective in their study during the initial half-hour following the procedure. FICB outperformed FNB after the sixth hour.

It also agreed with the conclusion reached by **Wallace and his co-workers** [16] who administered 0.5% ropivacaine (40 mL) in 60 patients who underwent knee arthroplasty. The FICB group experienced postoperative analgesia for a longer period of time than the FNB group. Additionally, the authors noted that the FIB group's long-term analgesic consumption was lower. They also advised that if achieving a fast onset of anaesthesia prior to induction is the main objective, they suggested FNB; if achieving a prolonged postoperative analgesia is the main objective, they suggested FICB block. The authors recommended FNB for rapid onset and FICB for a longer analgesic effect

Also, **Capdevila and his colleagues** [17] compared FNB and FICB in adults, they found that the two anterior approaches,eEffective postoperative analgesia is offered by FNB and FICB. The femoral nerves and lateral femoral cutaneous were simultaneously blocked more quickly and reliably with the fascia iliaca compartment technique. The spread of the anaesthetic locally under the fascia iliaca is what causes sensory block.

Another study conducted by **Dalens and his co-workers** [18], who compared both blocks in children, they discovered that, with moderate dosages of local anaesthetic, the fascia iliaca compartment block technique is easy, dependable, and offers a higher degree of sensory blockage of the lumbar plexus of nerves that innervate the lower limb. This method does not endanger any critical organs and does not call for any specialised knowledge or costly equipment.

On the other hand, **Morau and his co-workers'**[19] study revealed absence of a significant difference in the pain control effectiveness of the FICB and femoral nerve block in total knee arthroplasty patients. Patients received continuous femoral nerve block and fascia iliaca compartment block by catheter insertion, and no apparent difference was seen in VAS scores and opioid usage postoperatively.

CONCLUSION

The fascia iliaca compartment block versus femoral nerve block can significantly decrease pain in the early postoperative period as well as after 6, 12 and 24 hours with a significant lower opioid intake.

CONFLICT OF INTERST AND FUNDING

There were no conflicts of interest. No funding source provided any financial support for the research .

REFERENCES

1. **Aso K, Izumi M, Sugimura N (2019):** Additional benefit of local infiltration of analgesia to femoral nerve block in total knee arthroplasty: double-blind randomized control study. Knee Surg Sports Traumatol Arthrosc., 27: 2368–2374

2. **Seo S, Kim O, Seo J *et al.* (2017):** Comparison of the effect of continuous femoral nerve block and adductor canal block after primary total knee arthroplasty. Clin Orthop Surg., 9: 303–309.
3. **Gaffney C, Pelt C, Gililland J *et al.* (2017):** Perioperative pain management in hip and knee arthroplasty. Orthop Clin North Am., 48: 407–419.
4. **Aghayev E, Teuscher R, Neukamp M *et al.* (2013):** Course of radiographic loosening, pain and functional outcome around the first revision of a total hip arthroplasty. BMC Musculoskelet Disord., 14: 167.
5. **Wiederhold B, Garmon E, Peterson E *et al.* (2023):** StatPearls Publishing; Treasure Island (FL). Nerve Block Anesthesia. https://pubmed.ncbi.nlm.nih.gov/28613761
6. **Drasner K (2018):** Local Anesthetics. In: Katzung BG. eds. Basic & Clinical Pharmacology, 14ed New York, NY: McGraw-Hill.
7. **Nagel E, Gantioque R, Taira T (2019):** Utilizing ultrasound-guided femoral nerve blocks and fascia iliaca compartment blocks for proximal femur fractures in the emergency department. Adv Emerg Nurs J., 41(2):135-144
8. **Mariano E, Loland V, Sandhu N *et al.* (2009):** Ultrasound guidance versus electrical stimulation for femoral perineural catheter insertion. J Ultrasound Med., 28(11):1453-60.
9. **Capdevila X, Barthelet Y, Biboulet P *et al.* (1999):** Effects of perioperative analgesic technique on the surgical outcome and duration of rehabilitation after major knee surgery. Anesthesiology, 91:8.
10. **Allen H, Liu S, Ware P *et al.* (1998):** Peripheral nerve blocks improve analgesia after total knee replacement surgery. Anesth Analg., 87:93–7.
11. **Szczukowski M, Hines J, Snell J et al. (2004):** Femoral nerve block for total knee arthroplasty patients: a method to control postoperative pain. J Arthroplasty, 19:720.
12. **Singelyn F, Deyaert M, Joris D *et al.* (1998):** Effects of intravenous patient-controlled analgesia with morphine, continuous epidural analgesia, and continuous three-inone block on postoperative pain and knee rehabilitation after unilateral total knee arthroplasty. Anesth Analg., 87:88.
13. **Fowler S, Symons J, Sabato S *et al.* (2008):** Epidural analgesia compared with peripheral nerve blockade after major knee surgery: a systematic review and meta-analysis of randomized trials. Br J Anaesth., 100:154–64.
14. **Ganapathy S, Wasserman R, Watson J *et al.*(1999):** Modified continuous femoral three-in-one block for postoperative pain after total knee arthroplasty. Anesth Analg., 89:1197.
15. **Kanadli H, Dogru S, Karaman T *et al.* (2018):** Comparison of the efficacy of femoral nerve block and fascia iliaca compartment block in patients with total knee replacement. Minerva Anestesiol., 84:1134-41.
16. **Wallace J, Andrade J, Christensen J *et al.* (2012):** Comparison of fascia iliaca compartment block and 3-in-1 block in adults undergoing knee arthroscopy and meniscal repair. AANA J.,80(l):S37–44.
17. **Capdevila X, Biboulet P, Bouregba M *et al.* (1998):** Comparison of the three-in-one and fascia iliaca compartment blocks in adults: clinical and radiological analysis. Anesth Analg., 86(5):1039-1044.
18. **Dalens B, Vanneuville G, Tanguy A (1998):** Comparison of the fascia iliaca compartment block with the 3-in-1 block in children. Anesth Analg., 69:705–13.
19. **Morau D, Lopez S, Biboulet P *et al.* (2003):** Comparison of continuous 3-in-1 and fascia Iliaca compartment blocks for postoperative analgesia: feasibility, catheter migration, distribution of sensory block, and analgesic efficacy. Reg Anesth Pain Med., 28:309.