



REVISTA BRASILEIRA DE ANESTESIOLOGIA

Publicação Oficial da Sociedade Brasileira de Anestesiologia
www.sba.com.br



REVIEW ARTICLE

Femoral nerve block versus intravenous fentanyl in adult patients with hip fractures – a systematic review



Flávia Vieira Guimarães Hartmann^{a,b,c,d,*}, Maria Rita Carvalho Garbi Novaes^{e,f,g},
Marta Rodrigues de Carvalho^d

^a Hospital de Base do Distrito Federal, Brasília, DF, Brazil

^b Hospital Militar de Área de Brasília, Brasília, DF, Brazil

^c Fundação de Ensino e Pesquisa em Ciências da Saúde, Brasília, DF, Brazil

^d Escola Superior de Ciências da Saúde, Brasília, DF, Brazil

^e Farmácia Hospitalar, Departamento de Saúde, Brasília, DF, Brazil

^f Universidad del Chile, Santiago, Chile

^g Fundação de Ensino e Pesquisa em Ciências da Saúde, Escola Superior de Ciências da Saúde, Brasília, DF, Brazil

Received 29 June 2015; accepted 25 August 2015

Available online 19 April 2016

KEYWORDS

Hip fractures;
Femoral nerve block;
Analgesia;
Fentanyl

Abstract

Background: Hip fractures configure an important public health issue and are associated with high mortality rates and loss of functionality. Hip fractures refer to a fracture occurring between the edge of the femoral head and 5 cm below the lesser trochanter. They are common in orthopedic emergencies. The number of proximal femoral fractures is likely to increase as the population ages. The average cost of care during the initial hospitalization for hip fracture can be estimated about US\$ 7,000 per patient. Femoral fractures are painful and need immediate adequate analgesia. Treating pain femoral fractures is difficult because there are limited numbers of analgesics available, many of which have side effects that can limit their use. Opiates are the most used drugs, but they can bring some complications. In this context, femoral nerve blocks can be a safe alternative. It is a specific regional anesthetic technique used by doctors in emergency medicine to provide anesthesia and analgesia of the affected leg. **Objective:** To compare the analgesic efficacy of intravenous fentanyl versus femoral nerve block before positioning to perform spinal anesthesia in patients with femoral fractures assessed by Pain Scales.

Methods: A systematic review of scientific literature was conducted. Studies described as randomized controlled trials comparing femoral nerve block and traditional fentanyl are included. Two reviewers (MR and FH) independently assessed potentially eligible trials for inclusion. The methodology assessment was based on the tool developed by the Cochrane Collaboration for assessment of bias for randomized controlled trials. The Cochrane Library, Pubmed, Medline and Lilacs were searched for all articles published, without restriction of language or time.

* Corresponding author.

E-mail: flaviahartmann@bol.com.br (F.V. Hartmann).

<http://dx.doi.org/10.1016/j.bjane.2015.08.017>

0104-0014/© 2016 Published by Elsevier Editora Ltda. on behalf of Sociedade Brasileira de Anestesiologia. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

PALAVRAS-CHAVE

Fraturas de quadril;
Bloqueio do nervo femoral;
Analgésia;
Fentanil

Results: Two studies were included in this review. Nerve blockade seemed to be more effective than intravenous fentanyl for preventing pain in patients suffering from a femoral fracture. It also reduced the use of additional analgesia and made lower the risk for systemic complications. Femoral nerve block reduced the time to perform spinal anesthesia to the patient who will be subjected to surgery and facilitate the sitting position for this.

Conclusion: The use of femoral nerve block can reduce the level of pain and the need for additional analgesia. There are less adverse systemic events associated with this and the procedure itself does not offer greater risks. More studies are required for further conclusions.

© 2016 Published by Elsevier Editora Ltda. on behalf of Sociedade Brasileira de Anestesiologia. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Bloqueio do nervo femoral *versus* fentanil por via venosa em pacientes adultos com fraturas de quadril – revisão sistemática

Resumo

Justificativa: As fraturas de quadril são uma questão importante de saúde pública e estão associadas a altas taxas de mortalidade e perda de funcionalidade. As fraturas de quadril referem-se a uma fratura que ocorre entre a borda da cabeça femoral e cinco centímetros abaixo do trocanter menor e são comuns em emergências ortopédicas. O número de fraturas do fêmur proximal provavelmente aumentará à medida que a população envelhece. O custo médio da assistência médica durante a hospitalização inicial por fratura de quadril pode ser estimada em cerca de US\$7.000 por paciente. As fraturas do fêmur são dolorosas e requerem analgesia adequada imediata. O tratamento da dor causada por fraturas de fêmur é difícil porque há um número limitado de analgésicos disponíveis, muitos dos quais têm efeitos colaterais que podem limitar o seu uso. Os opioides são os fármacos mais utilizados, mas podem trazer algumas complicações. Nesse contexto, os bloqueios do nervo femoral podem ser uma alternativa segura. É uma técnica de anestesia regional específica usada por médicos em medicina de emergência para proporcionar anestesia e analgesia do membro afetado.

Objetivo: Comparar a eficácia analgésica de fentanil *versus* bloqueio do nervo femoral antes do posicionamento para realizar raquianestesia em pacientes com fratura de fêmur avaliados com escalas de dor.

Métodos: Revisão sistemática da literatura científica foi conduzida. Estudos descritos como ensaios clínicos randomizados que comparam bloqueio do nervo femoral e fentanil tradicional foram incluídos. Dois autores da revisão (MR e FH) avaliaram de forma independente os estudos potencialmente elegíveis para inclusão. A metodologia da avaliação baseou-se na ferramenta desenvolvida pela Colaboração Cochrane para avaliação de viés dos ensaios clínicos randomizados. As bases de dados da Biblioteca Cochrane, PubMed, Medline e Lilacs foram consultadas para todos os artigos publicados, sem restrições de língua ou de tempo.

Resultados: Dois estudos foram incluídos nesta revisão. O bloqueio do nervo pareceu ser mais eficaz que fentanil por via intravenosa para a prevenção da dor em pacientes com fratura femoral. Também reduziu o uso de analgesia adicional e diminuiu o risco de complicações sistêmicas. O bloqueio femoral reduziu o tempo de administração da raquianestesia ao paciente a ser submetido à cirurgia e facilitou a posição sentada para esse fim.

Conclusão: O uso de bloqueio do nervo femoral pode reduzir o nível de dor e a necessidade de analgesia adicional. Há menos eventos adversos sistêmicos associados a esse procedimento que não oferece maiores riscos. Mais estudos são necessários para conclusões adicionais.

© 2016 Publicado por Elsevier Editora Ltda. em nome de Sociedade Brasileira de Anestesiologia. Este é um artigo Open Access sob uma licença CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Hip fractures refer to a fracture occurring between the edge of the femoral head and 5 cm below the lesser trochanter. This is one of the most common orthopaedic emergencies.^{1,2}

Hip fractures configure an important public health issue. Its importance lies on the high mortality rates and loss of functionality it brings. They are largely linked to osteoporotic states and its incidence rates are known to increase exponentially with age in both women and men in most regions

of the world.³⁻⁵ Approximately 77,000 proximal fractures occur in the United Kingdom each year at an estimated cost of £ 2 billion.^{3,4} Nearly 300,000 hip fractures occur each year in the United States.⁶ The average cost of care during the initial hospitalization for hip fracture is about US\$ 7,000 per patient.⁶ According to the American Academy of Orthopaedic Surgeons, in 1988 the cost of hip fractures was \$ 8.7 billion, or US\$ 34,400 per patient.⁷ In Brazil there is few data about hip fractures. One research conducted in Rio de Janeiro demonstrated that hip fractures more frequently impair elderly people between 80 and 89 years, females with mild systemic disease.⁸ One study shows that the peak number of hip fractures occurs between the ages of 75 and 79 years in both men and women, and the number of individuals suffering the consequences of fracture is much larger than the annual incidence because some fractures incur disability for a period much longer than 1 year after the event.⁹

Approximately 98% of hip fractures are managed surgically, as fixation provides analgesia and chance of rehabilitation, and reduces the risk of complications.¹⁰ Femoral fractures are painful and need immediate adequate analgesia.^{11,12} At rest, approximately one-third of patients with a fractured hip will have mild (or no) pain, one-third will have moderate pain, and one-third will have severe pain. On movement, however, over three-quarters will have moderate to severe pain.¹⁰ Opiates and non-steroidal anti-inflammatory drugs are the common used drugs, but they can bring some complications¹³ and in the elderly this complications are even more serious because suboptimal metabolism due to loss of hepatic and renal functions. A femoral nerve block is a specific regional anesthetic technique used by doctors in emergency medicine to provide anesthesia and analgesia of the affected leg.¹⁴ It can reduce pain and opioid requirement in the preoperative period. They are also used as adjuncts to spinal and general anesthesia, and should always be considered when the latter is administered.¹⁰

Given these issues, the relevance of this review lies on the fact that as hip fractures tend to increase with ageing and we already observe the populational ageing new studies about treatment of safe and efficacy analgesia are required.

Objectives

The main goal of this review is to compare the analgesic efficacy of intravenous fentanyl versus femoral nerve block before positioning to perform spinal anesthesia in patients with femoral fractures assessed by Pain Scales.

Methods

The present study consists of a systematic review of scientific literature. Studies described as randomized controlled trials comparing femoral nerve block and traditional fentanyl were included. Two reviewers (MR and FH) independently assessed potentially eligible trials for inclusion. Disagreements were resolved by discussion with a third reviewer. Where necessary, the trialists were contacted for additional data and clarification. The methodology assessment was based on the tool developed by the Cochrane Collaboration for assessment of bias for randomized

controlled trials. There were included individuals from all ages and either gender presenting a femoral fracture. The Cochrane Library, PUBMED, MEDLINE and LILACS were searched for all articles published, without restriction of language or time. Titles and abstracts were analyzed for Medical Sub Headings (MeSH) terms. The following search terms were used: ('FEMORAL FRACTURES' [MESH] AND 'FENTANYL' [All Fields] AND 'NERVE BLOCK' [All Fields]). When it was necessary, the authors screened citations of the included studies or searched in another databases.

Results

The search was started in August 2014 and completed in November 2014. There were screened a total of 192 articles. However not all were suitable for inclusion and only 2 – accomplishing the characteristic mentioned above – were included in this review (Tables 1 and 2).^{15,16}

Discussion

Two small studies were included in this review: Sia 2004¹⁷ realized the study in Italy and Iamaron 2010¹⁸ conducted the trial in Thailand. Due to some difficulty in blinding research and participants and lack of intention to treat, most they present some type of bias in their methodology. This may limit the quality of the evidence.

Undertreated pain can lead to cardiovascular events, delirium; depression, sleep disturbances and decreased responses to interventions for other disease states.¹⁹ Pain can lead to metabolic, endocrine and electrolyte changes in the body. Moreover, the physiological responses to the damage can contribute to chronic persistent pain that can occur time after surgery.¹ Treating pain femoral fractures is difficult because there are limited number of analgesics available, many of which have side effects that can limit their use. The management of acute pain combines the use of systemic opioids, paracetamol and non-steroidal anti-inflammatory drugs.¹ Fentanyl is a lipophilic opioid stronger than morphine²⁰ commonly used in Brazil. It was developed 40 years ago for parenteral administration because due to a fast first-pass metabolism, oral administration is not available. Fentanyl belongs to phenylpiperidine family and is 50–100 times more potent than morphine.²¹ After an intravenous bolus, more than 80% of the administered dose can distribute from plasma to highly vascular tissues (heart, lung, and brain less than 5 min).²² In Brazil it is commonly used as an adjuvant drug used in general anesthesia.¹⁵ Among the 80s it was started to be used as an intraoperative analgesic agent with few adverse events. It can provide cardiovascular stability even in illness patients, but there is a direct concentration–effect relation between the fentanyl and respiratory depression. Doses higher than 2 ng/mL are associated with clinically significant respiratory depression. The degree of respiratory depression is affected by the types of surgical population, level of noxious stimulation, age, and individual pharmacodynamic responses.¹⁶

Femoral nerve block was introduced by Fenwick at Sydney Hospital in 1957 and since then it has gradually gained popularity.²³ Blockade of the femoral nerve can be performed using a nerve stimulator to identify the nerve and

Table 1 Iamaroon 2010.**Methods**

Randomized controlled trial. Patients allocated by computer-generated random numbers into two groups. Random allocation sequence concealed in opaque, sealed envelopes until a group was assigned.

Participants

Siriraj Hospital, Bangkok, Thailand.
64 participants (32 = FNB; 32 = Fentanyl) with femoral fractures:
Neck: 33 (FNB: 18; Fentanyl: 15)
Intertrochanteric: 21 (FNB: 18; Fentanyl: 13)
Shaft: 7 (FNB: 6; Fentanyl: 1)
Distal part of femur: 3 (FNB: 0; Fentanyl: 3)
Age: FNB (65.1 ± 17.5); Fentanyl (68.2 ± 12.4)
Sex (male/female): FNB 11/20; Fentanyl 12/20

Interventions

Femoral nerve block guided by a peripheral nerve stimulator using 30 mL of bupivacaine 0.3% (20 mL of bupivacaine 0.5% and 10 mL of normal saline 0.9%) versus 2 doses of IV fentanyl 0.5 µg with a 5 min interval between the doses.

Outcomes

Follow-up: from December 2006 to May 2008.
Pain scores 15 min after analgesia assessed by a numeric rating pain scale (FNB: 2.7 ± 2.6; fentanyl: 3.3 ± 2.7); $p = 0.37$
Pain scores during positioning for spinal anesthesia (FNB: 6.1 ± 2.6; Fentanyl: 5.9 ± 3.4); $p = 0.8$
Additional fentanyl requirement (FNB: 19.5 ± 16.4; Fentanyl: 17.1 ± 18.4); $p = 0.59$
Satisfaction of patient position (FNB: yes = 28; no = 4; Fentanyl: yes = 26; no = 6); $p = 0.49$
Time to perform spinal anesthesia (FNB: 7.0 ± 4.2; Fentanyl: 6.6 ± 4.3); $p = 0.74$

Notes

Assessors of pain were blinded to the patient's allocated treatment group.

Risk of Bias

Performance bias – patients were aware of their treatment group.

injecting local anesthetic close to the nerve; using a blind method named fascia iliaca block that uses large amounts of anesthetic; using another blind method named Three in One Block in a paravascular approach that can block the femoral, obturator and lateral cutaneous nerves with a single injection; or using an ultrasound guidance to identify the femoral nerve.²⁴ One survey conducted in England concluded that femoral nerve blocks are an underutilized effective method of analgesia for patients with a femoral fracture and it is associated with a low risk of compartment syndrome.²⁵

It is said that the use of femoral nerve blocks brings a low risk of adverse events, with the most likely being vascular haematoma, nerve damage, infection and intravascular infection.¹ Two other reviews concluded that nerve blockade seemed to be more effective than opioids alone for pre-

Table 2 Sia 2004.**Methods**

Randomized controlled trial. The patients were randomly divided into two groups: FNB (femoral nerve block) and IVA (IV analgesia).

Participants

Azienda Ospedaliera Careggi, Firenze, Italy.
Twenty patients presenting femoral shaft fractures.
Age: FNB (35 ± 11); IVA (32 ± 9).
Sex (male/female): FNB 7/3; IVA 6/4.

Interventions

Femoral nerve block guided by a peripheral nerve stimulator using 15 mL of lidocaine 1.5 versus one dose of IV fentanyl 3 µg/kg.

Outcomes

Follow-up: from September 2002 to November 2003.
Visual Analogue Pain Scores at positioning for spinal anesthesia 5 min after interventions: FNB = 0.5 ± 0.5; IVA = 3.3 ± 1.4; $p < 0.001$
Time to perform spinal anesthesia after intervention (min): FNB = 1.8 ± 0.7; IVA = 3.0 ± 1.1; $p < 0.05$
Quality of patient position (0 to 3): FNB = 2.8 ± 0.4; IVA = 1.6 ± 0.7; $p < 0.005$
Patient acceptance (yes/no); FNB = 10/0; IVA = 6/4.

Notes**Risk of Bias**

Risk of selection bias – the author does not mention the randomization criteria nor the allocation concealment.

venting pain in patients suffering from a femoral fracture. This was showed by comparing scores assessed by different recognized scales which measures pain before and after the procedure.^{13,26} Previous studies have demonstrated the efficacy of nerve blocks.^{27,28} Although Iamaroon¹⁸ did not report statistically significant analgesic effect between femoral nerve block and intravenous fentanyl, Sia¹⁷ showed that the scores of pain at positioning for spinal anesthesia and the time required to perform spinal anesthesia were lower in the group that received femoral nerve block. The quality of patient position and the patient acceptance were higher in the group submitted to the femoral nerve block. May be the inconclusive effects of Iamaroon were due to suboptimal dose of local anesthetic.

Berry²³ in 1997 stated that the femoral nerve block provides almost total pain relief and abolition of muscle spasm within a few minutes; there is negligible systemic reaction to the block procedure; pain during procedures which often necessitate patient movement can be prevented.

Conclusions

The use of femoral nerve block seems to be more effective than intravenous fentanyl. But the small sample, the lack of uniformity and the bias diminish the quality of evidence. There are necessary more comparative studies for further conclusions.

Conflicts of interest

The authors declare no conflicts of interest.

References

- Layzell MJ. Use of femoral nerve blocks in adults with hip fractures. *Nurs Stand*. 2013;27:49–56 [quiz 58].
- Watson MJ, Walker E, Rowell S, et al. Femoral nerve block for pain relief in hip fracture: a dose finding study. *Anaesthesia*. 2014;69:683–6.
- Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. *Lancet*. 2002;359:1761–7.
- White SM, Griffiths R. Projected incidence of proximal femoral fracture in England: a report from the NHS Hip Fracture Anaesthesia Network (HIPFAN). *Injury*. 2011;42:1230–3.
- Melton LJ 3, Cooper C. Magnitude and impact of osteoporosis and fractures. In: Marcus R, Feldman D, Kelsey J, editors. *Osteoporosis*, 1, 2nd ed. San Diego: Academic Press; 2001. p. 557–67; Apple D, Hayes W. *Prevention of falls and hip fractures in the elderly*. Rosemont, IL: AAOS; 1994.
- Johnell O. The socioeconomic burden of fractures: today and in the 21st century. *Am J Med*. 1997;103:205–5S [discussion 5S–6S].
- Praemer A, Furner S, Rice DP. *Musculoskeletal conditions in the United States*. Park Ridge, IL: American Academy of Orthopedic Surgeons; 1992.
- Vidal EIO. Capítulo 2: Clinical profile of elderly Brazilians with hip fracture: comorbidities, treatment, patterns, complications and mortality. In: *Aspectos epidemiológicos das fraturas do fêmur proximal em idosos* [Tese de Doutorado] Campinas, SP:[s.n.]; 2010. p. 61–76.
- Johnell O, Kanis J. An estimate of the worldwide prevalence, mortality and disability associated with hip fracture. *Osteoporos Int*. 2004;15:897–902.
- Maxwell L, White S. Anaesthetic management of patients with hip fractures: an update. *Cont Educ Anaesth Crit Care Pain*. 2013;13:179–83.
- Tam CW, Rainer TH. Femoral nerve block for pain management of femoral fractures in the emergency department: evidence based topic review. *Hong Kong J Emerg Med*. 2013;12:178–81.
- Haines L, Dickman E, Ayvazyan S, et al. Ultrasound-guided fascia iliaca compartment block for hip fractures in the emergency department. *J Emerg Med*. 2012;43:692–7.
- Parker MJ, Griffiths R, Appadu B. Nerve blocks (subcostal, lateral cutaneous, femoral, triple, psoas) for hip fractures (review). *Cochrane Database Syst Rev*. 2002;1:CD001159.
- Bogacz A, Jamison M. Femoral nerve block – a guide for medical students and junior doctors. *Scot Univ Med J*. 2012;185–91.
- Brasil. Ministério da Saúde. Secretaria de Ciência, Tecnologia e Insumos Estratégicos. Departamento de Assistência Farmacêutica e Insumos Estratégicos. *Relação nacional de medicamentos essenciais: Rename/Ministério da Saúde, Secretaria de Ciência, Tecnologia e Insumos Estratégicos, Departamento de Assistência Farmacêutica e Insumos Estratégicos*. – 7. ed. – Brasília: Ministério da Saúde, 2010. 250 p.: il. – (Série B. Textos Básicos de Saúde).
- Peng PW, Sandler AN. A review of the use of fentanyl analgesia in the management of acute pain in adults. *Anesthesiology*. 1999;90:576–99.
- Sia S, Pelusio F, Barbagli R, et al. Analgesia before performing a spinal block in the sitting position in patients with femoral shaft fracture: a comparison between femoral nerve block and intravenous fentanyl. *Anesth Analg*. 2004;99:1221–4.
- Iamaroon A, Raksakietisak M, Halilamien P, et al. Femoral nerve block versus fentanyl: analgesia for positioning patients with fractured femur. *Local Reg Anesth*. 2010;3:21–6.
- Abou-Setta AM, Beaupre LA, Rashiq S, et al. Comparative effectiveness of pain management interventions for hip fracture: a systematic review. *Ann Intern Med*. 2011;155:234–45.
- Ginosar Y, Riley ET, Angst MS. The site of action of epidural fentanyl in humans: the difference between infusion and bolus administration. *Anesth Analg*. 2003;97:1428–38.
- Vardanyan RS, Hruby VJ. Fentanyl-related compounds and derivatives: current status and future prospects for pharmaceutical applications. *Future Med Chem*. 2014;6:385–412.
- Glass PSA, Shafer SL, Jacobs JR, et al. Intravenous drug delivery systems. In: Miller RD, editor. *Anesthesia*. 4th ed. New York: Churchill Livingstone; 1994. p. 389–416.
- Berry FR. Analgesia in patients with fractured shaft of femur. *Anaesthesia*. 1977;32:576–7 [PubMed; PMID 879471].
- Mittal R, Vermani E. Femoral nerve blocks in fractures of femur: variation in the current UK practice and a review of the literature. *Emerg Med J*. 2014;31:143–7.
- Pennington N, Gadd RJ, Green N, et al. A national survey of acute hospitals in England on their current practice in the use of femoral nerve blocks when splinting femoral fractures. *Injury*. 2012;43:843–5.
- Black KJL, Bevan CA, Murphy NG, et al. Nerve blocks for initial pain management of femoral fractures in children (review). *Cochrane Database Syst Rev*. 2013;17:CD009587.
- McGlone R, Sadhra K, Hamer DW, et al. Femoral nerve block in the initial management of femoral shaft fractures. *Arch Emerg Med*. 1987;4:163–8.
- Barriot P, Riou B, Ronchi L, et al. Femoral nerve block in pre-hospital care management of fractured shaft of femur. *JEUR*. 1988;1:21–4.