Spinal vs. intra-joint anesthesia in knee arthroscopy

Lucas D. Marangoni, Roxana Giacossa, Alejandro Malvarez, Iván Bitar, Damián Bustos, Horacio Galera, Pablo Bertiche

Department of Orthopedics, Sports Medicine and Arthroscopy Section
Sanatorio Allende, Córdoba

Received on October 31st, 2015; accepted after evaluation on May 12th, 2016 • LUCAS D. MARANGONI, MD • marangonilucas@hotmail.com

Abstract

Introduction: Knee arthroscopy is the commonest surgical procedure to treat patients with meniscal or chondral injuries. The aim of this study was to compare the benefits of spinal vs. intra-joint anesthesia in simple knee arthroscopy, to assess the quality of the anesthesia, to describe the incidence of adverse effects and to determine complications in both cases.
Materials and methods: Prospective randomized study to compare two anesthetic procedures evaluating age, surgery duration, anesthetic duration, hospital staying time, pain, patients' satisfaction with the procedure, and costs. We used the Student's t test for statistics and probabilities. Signification level was: $p<0.005$.
Results: We included 70 patients; 35 were operated on with intra-joint anesthesia, whereas 35 were operated on with spinal anesthesia. Hospital staying was longer in the spinal anesthesia group (7.34 h; range 4-11) than in the intra-joint group (3.43 h; range 2-5), $p<0.0001$. In costs variable, there were significant differences in favor of intra-joint anesthesia with respect to spinal anesthesia ($p<0.0001$).
Conclusion: The advantages found in favor of intra-joint anesthesia were: shorter hospital staying and no undesirable effects associated with spinal anesthesia (motor block, nauseas, vomits, low blood pressure, temporary urinary sphincter deficit, and urinary retention [bladder globe]); costs decrease and greater acceptance by patients.

Key words: knee arthroscopy; local anesthesia; intra-joint anesthesia.
Level of evidence: I

Anestesia raquídea versus anestesia intrarticular en cirugía artroscópica de rodilla

Resumen

Introducción: La artroscopia de rodilla es el procedimiento quirúrgico más común para tratar pacientes con lesiones meniscales o condrales. El objetivo de este trabajo fue comparar la eficacia de la anestesia raquídea versus la intrarticular en artroscopias simples de rodilla, evaluar la calidad de la anestesia, describir la incidencia de los efectos adversos y determinar las complicaciones en ambos casos.
Materiales y Métodos: Estudio prospectivo, aleatorizado para comparar dos procedimientos anestésicos mediante la evaluación de la edad, el tiempo de cirugía, la duración de la anestesia, el tiempo de internación, el dolor, la conformidad con el procedimiento y los costos. Se utilizó el test t de Student para las estadísticas y probabilidades. Nivel de significación: $p <0,05$.

Conflict of interests: The authors have reported none.

http://dx.doi.org/10.15417/562

Resultados: Se incluyó a 70 pacientes, 35 fueron operados con anestesia intrarticular y 35, con anestesia raquídea. El tiempo de internación fue mayor en el grupo de anestesia raquídea (7.34 h; rango 4-11) que en el grupo de anestesia intrarticular (3.43 h; rango 2-5), p <0,0001. En la variable costo, hubo una diferencia significativa a favor de la anestesia intrarticular con respecto a la anestesia raquídea (p <0,0001).
Conclusión: Las ventajas encontradas a favor de la anestesia intrarticular fueron: estadías hospitalarias acortadas, se evitaron efectos indeseables de la anestesia raquídea (bloqueo motor, náuseas, vómitos, hipotensión, pérdida transitoria de esfínter urinario y retención urinaria [globo vesical]); disminución de los costos y mayor aceptación de los pacientes.

Palabras clave: Artroscopia de rodilla; anestesia local; anestesia intrarticular.
Nivel de Evidencia: I

Introduction

Knee arthroscopy is the commonest surgical procedure for the treatment of patients with mensical and chondral injuries; many times, it is also useful for the diagnosis of hidden injuries.[1-3]

Intra-joint anesthesia for knee arthroscopy is a procedure that offers advantages compared to other types of anesthesia—it is given without ischemia, it has less hemodynamic effects,[4] shorter duration, shorter hospital staying, less associated complications,[5] good post-operative analgesia and lower costs.[6-10]

The aims of this study can be divided into two: Primary Aims (comparison between spinal anesthesia and intra-joint anesthesia in simple knee arthroscopy) and Secondary Aims: (assessment of the quality of the anesthesia, description of adverse effects, and determination of complications in both cases).

Materials and Methods

We carried out a prospective randomized study to compare spinal anesthesia to intra-joint anesthesia in patients with meniscal or chondral injuries who had been prescribed arthroscopic treatment. We used the Student's t test for statistical analysis and probabilities. The significance level was p=0.05.

The sample was randomly divided into two groups: Group A (patients subject to spinal anesthesia), and Group B (those who received intra-joint anesthesia). This piece of research was accepted by the patients in the informed consent.

The inclusion criteria were: a) patients of both sexes of 16-60 years of age, b) ASA I-II anesthetic risk, c) degrees I-II-III (ICRS) meniscal or chondral injuries, d) intra-joint disease. The exclusion criteria were: a) patients outside the established range of age, b) ASA III-IV anesthetic risk, c) allergy to local anesthetic compounds of the amide type (lidocaine and bupivacaine), d) associated ligament injuries requiring surgical treatment, e) grade IV osteochondral injuries (ICRS), f) "bucket handle" meniscal tear whose treatment is meniscal repair and g), septic osteoarthritis.

We assessed different variables:

1) Age
2) The use of haemostatic cuff
3) The anesthetic procedure in which two types of anesthesia were administered: Group A, spinal anesthesia with 15 mg hyperbaric bupivacaine with no intrathecal opioids at L3-L4 or L4-L5 levels, with aseptic technique and the patient sitting; Group B, intra-joint anesthesia, access to the joint in the superior-lateral area with aseptic technique, administering 15 ml 0.25% bupivacaine with epinephrine plus 15 ml 1% lidocaine with epinephrine, all dissolved in 10 ml saline solution— a total of 40 ml intra-joint anesthesia.
   Afterwards we gave local sub-dermal anesthesia in the arthroscopic portals: 5 ml 0.25% bupivacaine with epinephrine plus 5 ml 1% lidocaine with epinephrine, all dissolved in 5 ml saline solution—a total of 15 ml, 7.5 ml in each arthroscopic portal. We used anesthesia plus epinephrine to avoid greater bleeding during the surgey and using the hemostatic cuff if possible. Ten minutes after administering anesthesia (latency time), arthroscopy starts.
   All patients before had received sedation with 3 mg i.v. midazolam. During the surgery, the patients in both groups were given intravenous drip of two diclofenac blisters in 400 ml saline solution. This procedure was always carried out by the Department of Anesthesia supervised by the surgeon.
4) Surgery duration (we calculated surgery duration since the production of the arthroscopic portals until skin stitching).
5) Pain during the surgery at varus-valgus manouvers; moreover, we assessed post-operative pain at the time of discharge using the visual analogue scale (VAS) for pain with values from 0 (no pain) to 10 (maximal imaginable pain). After the surgery we used the same analgesia protocol and antibiotic prophylaxis in both groups: 20 mg i.v. ketorolac, unique dose, 2 h after the surgery, and 1 g i.v. cefadroxilo, unique dose, before discharge. Those who suffered intense post-operative pain were given 5 ml Klosidol® (dextropropoxyphene plus dipyrone), one i.v. blister, unique dose, before discharge.

6) Anesthesia recovery time (we calculated the number of hours both spinal and regional anesthesia lasted)
7) Hospital staying time (we calculated how long the patient was in hospital to compare hours between local and spinal anesthesia)
8) Degree of patients' satisfaction (we evaluated subjective patients' satisfaction with respect to the anesthesia mainly on the basis of pain during the surgery and post-operative pain)
9) Complications during the anesthetic procedure, complications during surgery and post-operative complications.
10) Costs of spinal anesthesia and those of intra-joint anesthesia.

All surgeries were performed by the same surgeon, and the anesthetic procedure with control of sedation was carried out by the Department of Anesthesia.

Results

We compared 70 patients (49 males and 21 females) from June 2012 to December 2013 (Table). Thirty-five patients were operated on with intra-joint anesthesia and 35, with spinal anesthesia. Average age was 35 years old. We used haemostatic cuff in six patients in Group A due to profuse bleeding during surgery to improve vision; no patient in Group B was operated on with haemostatic cuff.

The average duration of all the surgeries was 34.5 m; surgery duration was 36.5 m (ranging from 24 to 55) in the group of spinal anesthesia and 32.5 m (ranging from 25 to 45) in the group of intra-joint anesthesia (p=0.281, non-significant).

Ten patients in Group B reported mild pain during the surgery (VAS 1 or 2); one of them reported to feel intense pain while receiving bone marrow stimulation by microfractures (VAS 8) for the treatment of chondral injury; the rest of the patients reported pain while receiving forced valgus or the necessary varus for compartment opening during the surgery. In Group A, two patients suffered pain caused by the haemostatic cuff and needed sedation during the surgery (VAS 2 and 7) (p=0.069, non-significant, for the two types of anesthesia) (Figure).

Average post-operative VAS pain was 2 (ranging from 0 to 8) in Group A, and 1.6 (ranging from 0 to 9) in Group B. Two patients in Group A and one patient in Group B needed rescue analgesia (Klosidol®) (p=0.79, non-significant).

Hospital staying was longer in the group of spinal anesthesia (7.34 h; ranging from 4 to 11) and was calculated since the patient was admitted to the Day Hospital Area until the patient's discharge with post-operative prescriptions. In the group of intra-joint anesthesia, average hospital staying was 3.43 h (ranging from 2 to 5) (p<0.0001, statistically significant in favor of intra-joint anesthesia). This variable was highly dependent on the resident's job.

Three patients in Group B (5.5%) reported to feel unsatisfied with the procedure with respect to pain, whereas five patients in Group A (14.3%) were hardly satisfied with the anesthesia due to adverse effects (nausea, vomits, urinary retention, bladder globe and low blood pressure) during and after the procedure.

Table. Patients' characteristics

	Type of anesthesia		
	Spinal	**Intra-joint**	**p**
Sex	Females = 12 Males = 26	Females = 9 Males = 23	
Age	36 years old (range 18-56)	33 years old (range 21-60)	
Surgical duration	36.5 min (range 24-55)	32.6 min (range 25-45)	p = 0.2811 (NS)
Intra-operative pain	2 patients	10 patients	p = 0.069 (NS)
Anesthesia duration	4.6 h (range 3-7)	1.26 h (range 1-2)	p <0.0001 (S)
Hospital staying time	7.34 h (range 4-11)	3.43 h (range 2-5)	p <0.0001 (S)
Post-operative pain	VAS 2 (range 0-8)	VAS 1,6 (range 0-9)	p = 0.79 (S)
Other post-operative symptoms	Headaches (4 patients)	No	
Cost	ARS190	ARS106	p <0.0001 (S)
Haemostatic cuff	6 patients	No	

VAS = visual analogue scale; S = statistically significan; NS = statistically non-significant.

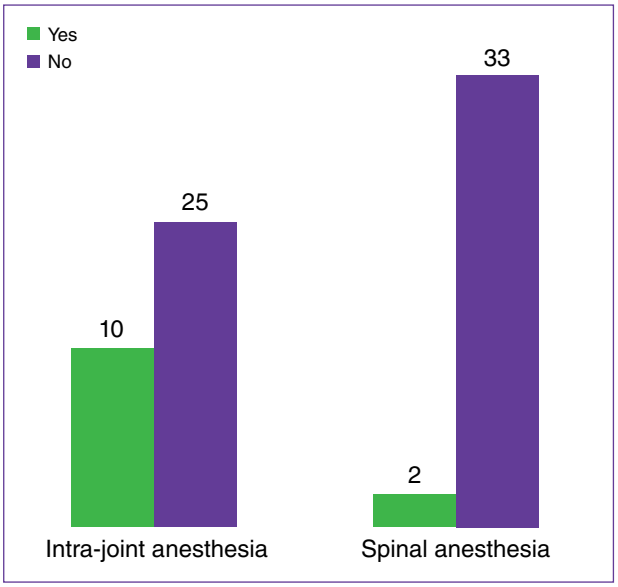

Figure. Intra-operative pain.

Four patients in Group A (7.4%) suffered different degrees of post-operative headache. Three patients (5.5%) in Group A suffered temporary post-operative deficit in sphincter control and, one of them, required to be given temporary bladder catheter due to bladder globe (p=0.2549, non statistically significant).

Average anesthesia recovery time was 4.6 h (ranging from 3 to 7) in Group A and 1.26 h (ranging from 1 to 2) in Group B (p<0.0001, statistically significant in favor of the group of intra-joint anesthesia). There were no infectious complications in any of the groups, nor were there complications stemming from the anesthetic procedure. In no case was it necessary to convert the patient into general anesthesia.

To administer spinal anesthesia, we needed a G27 needle (ARS120) plus a blister of 0.5% hyperbaric bupivacaine (ARS70), total amount= ARS190, whereas for intra-joint anesthesia we used a 20 ml bottle of bupivacaine with epinephrine (ARS50) plus another 20 ml bottle of lidocaine with epinephrine (ARS56), total amount= ARS106 (p<0.0001, significant difference with respect to spinal anesthesia).

Discusion

Different authors have studied the relationship between pain and other variables in patients operated on due to simple knee injuries by arthroscopic procedures, using regional and local (intra-joint) anesthesia; some of them also studied whether or not it is necessary to add any kind of sedation during the surgery.[1-3] Other randomized studies compare regional anesthesia to general anesthesia.[4]

In our series, we found greater acceptance by patients operated on with intra-joint anesthesia than by those operated on with spinal anesthesia (less fear of the local procedure).

Moreover, with this procedure costs and hospital staying might decrease, as complications due to the haemostatic cuff may—injuries caused by microvascular, neural and myofibrillar compression, for one thing, which can last days or weeks depending on the level of pressure and the insufflation time; and also pain during the surgery and post-operative pain, and complications such as venous thrombosis, which increase with the use of the haemostatic cuff. What is more, intra-joint anesthesia allows the surgeon to evaluate patellar-femoral mobility more accurately.

Vidal et al.[3] did not find significant differences in the intra-operative VAS score, although they did find significant post-operative VAS scores, and concluded that the association between bupivacaine and fentanyl offers post-operative advantages with constant and safe dosis.

We recommended intra-joint anesthesia in simple knee arthroscopy in those patients who did not show considerable hemarthrosis or hydrarthrosis. We did not use the extended block for the lateral or medial collateral ligaments described by Hultin.[5]

Other reports describe the benefits of local anesthesia for knee arthroscopies, and it has been showed that local anesthesia is more affordable than spinal anesthesia; however, there are no statistically significant differences in the patients' results six months after the surgery.[6-13] Shapiro et al.[14] evaluate local anesthesia for simple knee arthroscopies; moreover, they compare spinal anesthesia with general anesthesia and conclude that the technique of local anesthesia is an effective method for simple arthroscopies in cost-benefits terms.

Different methods are used for post-operative analgesia in knee arthroscopy—one of them is intra-joint instillation of pain-killers, among which bupivacaine is the most frequently administered because of its lasting action and good analgesic effects, and an ideal drug for arthroscopy post-operative analgesia. Other agents are: morphine, ropivacaine, ibuprofen, ketorolac, and tramadol.[15-28] In our study, we did not use any intra-joint pain-killer at the end of the arthroscopy.

Over the past few years, numerous reports have been suggesting that intra-joint pain-killers have toxic effects on chondrocytes. There is still some controversy over the mechanism of action and the dosis that may produce undesirable effects on joints. In our study, there were no complications associated with the use of intra-joint anesthetic compounds—we did not use infusion pump, one of the factors associated with chondrolysis in different joints (knee, shoulder, hip).[28-31]

We administered lidocaine, since it is associated with faster onset of action and, this way, it allows the surgeon

immediate block and, this way, to start operating on faster; bupivacaine has a 30-minute delay in intra-joint fixation. Using lidocaine and bupivacaine associated with epinephrine produces vasoconstriction, which ensures an increase in the half-life of the anesthetic compounds and decreases joint bleeding.

The main limitation to our study is the amount of patients who were assesses which, compared to other series, represents a scarce number of patients; its strength is the fact that it is an original, prospective, randomized study.

Conclusions

According to the results we got, we may acknowledge that intra-joint anesthesia is a simple, safe and welcome method for patients; it is associated with scarce morbidity and good pain tolerance, decreasing costs and hospital staying.

The advantages in favor of intra-joint anesthesia that we found are: 1) shorter hospital staying, 2) no undesirable effects associated with spinal anesthesia (motor block, nauseas, vomits, low blood pressure, temporary urinary sphincter deficit, and urinary retention [bladder globe]), 3) lower costs and, 4) greater acceptance by patients.

Bibliography

1. Dunn WR, Cordasco FA, Flynn E, Jules K, Gordon M, Liguori G. A prospective randomized comparison of spinal versus local anesthesia with propofol infusion for knee arthroscopy. *Arthroscopy* 2006;22(5):479-83.
2. Mondino JA. Artroscopia de rodilla con anestesia local. *Artroscopia* 2006;13(2):102-10.
3. Vidal F, Garcia M. Anestesia intra-articular en la artroscopia de la rodilla, estudio comparativo doble ciego. *Rev Mex Ortop Traum* 2000;14(2):196-9.
4. Goranson BD, Lang S, Cassidy JD, Dust WN, McKerrell J. A comparison of three regional anaesthesia techniques for outpatient knee arthroscopy. *Can J Anaesth* 1997;44(4):371-6.
5. Hultin J. Knee arthroscopy using local anesthesia. *Arthroscopy* 1992; 8(2):239-41.
6. Cannon WD, Morgan CD. Meniscal repair-instructional course lectures. *J Bone Joint Surg Am* 1994;76:294-311.
7. Graft D, Good R. Delayed hipersensitivity reaction of the knee a injection of arthroscopy portals with bupivacaine (marcaine). *Arthroscopy* 1994; 10(3):305-8.
8. Bollini CA, Arce G, Lacroze P. Anestesia local intraarticular para la artroscopia de rodilla: experiencia clínica. *Rev Arg Anestesiol* 1994;52(2):83-8.
9. Williams CR, Thomas NP. A prospective trial of local versus general anaesthesia for arthroscopic surgery of the knee. *Ann R Coll Surg Engl* 1997;79(5):345-8.
10. Karaoglu S, Dogru K, Kabak , Inan M, Hlici M. Effects of epinephrine in local anesthetic mixtures on hemodynamics and view quality during knee arthroscopy. *Arthroscopy* 2000;16 (2):183-90.
11. McGinty JB, Matza RA. Arthroscopy of the knee. Evaluation of an out-patient procedure under local anesthesia. *J Bone Joint Surg Am* 1978;60:787-9.
12. Ben DB, De Meo PJ, Lucyk C, Solosko D. A comparison of minidose lidocaine-fentanyl spinal anesthesia and local anesthesia/ propofol infusión for outpatient knee arthroscopy. *Anesth Analg* 2001;93:319-25.
13. Jacobson E, Forssblad M, Rosenberg J, Westman L, Weidenhielm L. Can local anesthesia be recommended for routine use in elective knee arthroscopy? A comparison between local, spinal, and general anesthesia. *Arthroscopy* 2000;16(2):183-90.
14. Shapiro MS, Safran MR, Crockett H, Finerman GAM. Local anesthesia for knee arthroscopy, efficacy and cost benefits. *Am J Sports Med* 1995; 23(1):76-119.
15. Pellaci F, Beluzzi R, Martini A. Outpatient arthroscopy. *Chir Organi Mov* 1996;81:165-72.
16. Horlocker TT, Hebl JR. Anesthesia for outpatient knee arthroscopy: is there an optimal technique? *Reg Anesth Pain Med* 2003; 28(1):58-63.
17. Illigan KA, Mowbray MJ, Mulrooney L, Standen PJ. Intra-articular bupivacaine for pain relief after arthroscopic surgery of the knee joint in daycase patient. *Anaesthesia* 1988l;43(7):563-4.
18. Jacobson E, Forssblad M, Weidenhielm L. Knee arthroscopy with the use of local anesthesia--an increased risk for repeat arthroscopy? A prospective, randomized study with a six-month follow-up. *Am J Sports Med* 2002;30(1):61-5.
19. Raja SN, Dickstein RE, Johnson CA. Comparison of postoperative analgesic effects of intraarticular bupivacaine and morphine following arthroscopic knee surgery. *Anesthesiology* 1992;77(6):1143-7.
20. Reuben SS, Connelly NR. Postoperative analgesia for outpatient arthroscopic knee surgery with intraarticular bupivacaine and ketorolac. *Anesth Analg* 1995;80:1154-7.

21. Pedowitz RA. Tourniquet induced neuromuscular injury. *Acta Orthop Scand* 1991;62(Suppl 245):1-33.

22. Gersoff WK, Ruwe P, Jokl P, Panjabi M. The effect of tourniquet pressure on muscle function. *Am J Sports Med* 1989;17:123-7.

23. Maldini B, Miskulin M, Antolić S, Goranović T, Sakić-Zdravcević K, Gudelj G, et al. Local or spinal anesthesia in acute knee surgery. *Coll Antropol* 2010;34(Suppl 1): 247-54.

24. Forssblad M, Jacobson E, Weidenhielm L. Knee arthroscopy with different anesthesia methods: a comparison of efficacy and cost. *Knee Surg Sports Traumatol Arthrosc* 2004;12(5); 344-9.

25. Birkner W, Henche HR. 18 years of experience in knee arthroscopy under local anesthesia. *Diagn Ther Endosc* 1996; 3(1):1-7.

26. Baker JF, Mulhall KJ. Local anaesthetics and chondrotoxicty: What is the evidence? *Knee Surg Sports Traumatol Arthrosc* 2012;20:2294-301.

27. Townshend D, Emmerson K, Jones S, Partington P, Muller S. Intra-articular injection versus portal infiltration of 0.5% bupivacaine following arthroscopy of the knee. A prospective, randomised double-blinded trial. *J Bone Joint Surg Br* 2009;91(5):601-3.

28. Noyes FR, Fleckenstein CM, Barber-Westin SD. The development of postoperative knee chondrolysis after intra-articular pain pump infusion of an anesthetic medication. A series of twenty-one cases. *J Bone Joint Surg Am* 2012;94:1448-57.

29. Buchko JZ, Gurney-Dunlop T, Jason J. Shin pump catheter after arthroscopic ACL reconstruction knee chondrolysis by infusion of bupivacaine with epinephrine through an intra-articular pain. *Am J Sports Med* 2015;43: 337-44.

30. Campo MM, Kerkhoffs GM, Sierevelt IN, Weeseman RR, Van der Vis HM, Albers GH. A randomised controlled trial for the effectiveness of intraarticular ropivacaine and bupivacaine on pain after knee arthroscopy: the DUPRA (DUtch Pain Relief after Arthroscopy)-trial. *Knee Surg Sports Traumatol Arthrosc* 2012;20:239-44.

31. Lintner S, Shawen S, Lohnes J, Levy A, Garrett W. Local anesthesia in outpatient knee arthroscopy: a comparison of efficacy and cost. *J Arthrosc Relat Surg* 1996;12(4):482-8.