View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

Acta Clin Croat 2006; 45(Suppl 1): 81-86

POSSIBILITIES OF ANESTHESIA COST MANAGEMENT BY ANALYSIS OF DIFFERENT ANESTHESIOLOGY TECHNIQUES

Ivan Šklebar[1], Nada Vranko-Nagy[1] and Duška Šklebar[2]

[1]Department of Anesthesiology and Intensive Care,
[2]Department of Neurology, Bjelovar General Hospital, Bjelovar, Croatia

SUMMARY – The must of material cost rationalization in medical practice has stimulated the authors to analyze the structure of material expenses of spinal and general anesthesia on a model of arthroscopic knee surgery. The aim was to determine whether the cost of spinal anesthesia was still lower than that of general anesthesia after the introduction of expensive atraumatic needles. In addition, we were interested in the extent to which our daily practice correlated with that in industrialized countries and what were the possibilities of cost rationalization. Using retrograde analysis of two comparable groups of 40 patients each, submitted to arthroscopic knee surgery in general or spinal anesthesia, the anesthesia material expenses were divided into variable and constant expenses that are partially common to both types and partially specific for each type of anesthesia. The sums of variable and specific expenses were compared between the two types of anesthesia, amounting to 78.26 HRK for spinal anesthesia and 115.19 HRK for general anesthesia. There were no major operative or postoperative complications in either patient group. As only 40% of the procedures were performed in spinal anesthesia, whereas the respective figure in industrialized countries exceeds 70%, there is obviously much room for savings. If the percent of the procedures performed in spinal anesthesia were increased to the feasible 60%, a saving of 1470 HRK would be achieved exclusively in knee arthroscopy surgery, considering that some 200 procedures have been performed *per* year.

Key words: *Anesthesia – economics; Health care costs; Cost and cost analysis; Anesthesia – methods*

Introduction

The constant rise of health care costs and the system of health service payment *per* therapeutic procedure entail an ever growing need of cost structure analysis for each medical procedure. The aim is to identify the procedures or particular items that allow for cost rationalization while not compromising the quality of health service. With this in mind, we analyzed material expenses of general *versus* spinal anesthesia in arthroscopic knee surgery. Spinal anesthesia is as safe a technique as general anesthesia and until recently considerably less expensive than the latter while using classic spinal needles[1]. Due to the occurrence of uncomfortable puncture headache, especially in young patients, described in 5%-40% of patients, 26-29 G fine needles with atraumatic point have lately been ever more frequently used[2]. With the use of these needles, the rate of headache falls to less than 1%[3], however, their price is currently fivefold (58.94 HRK *vs.* 10.80 HRK). This in turn poses a question of whether the cost of spinal anesthesia with a predominant use of atraumatic needles is still significantly lower than that of general anesthesia. The aim of the study also was to assess the rate of using either anesthesiology technique in our routine. In industrialized countries, up to 75% of orthopedic procedures on lower extremities are performed in spinal anesthesia[4].

Correspondence to: *Ivan Šklebar, MD, MS,* Department of Anesthesiology and Intensive Care, Bjelovar General Hospital, Mihanovićeva 8, HR-43000 Bjelovar, Croatia

E-mail: ivan.sklebar@bj.htnet.hr

Material and Methods

Arthroscopic knee operations performed between June 1 and December 31, 2004 were retrogradely analyzed. During the study period, a total of 99 arthroscopic knee procedures were carried out, 40 in spinal block and 59 in general anesthesia. Nineteen youngest patients were excluded from the general anesthesia group in order to obtain patient samples comparable according to age and ASA status. Thus, two comparable groups of 40 patients each were formed.

Data on material expenses of anesthesia, divided into variable and constant expenses, were processed by use of Excel software, and tabularly and graphically presented with basic statistical and t^2-test analysis. On calculating the price of anesthesia, the reference price of the Croatian Institute of Health Insurance or purchase price provided by the hospital pharmacy was used[5,6].

Spinal block was produced with oral or intravenous premedication with midazolam with or without atropine, using atraumatic (n=22) or classic (n=18) spinal needle and 0.5% bupivacaine as local anesthetic, with standard infusions and rarely additional analgesia with fentanyl.

General anesthesia was preceded with the same premedication. Thiopental or propofol was used for anesthesia induction, with succinylcholine or vecuronium for relaxation. Anesthesia was maintained with fentanyl and a mixture of O_2/N_2O at a 1:2 ratio, with vecuronium for relaxation.

The group operated on in spinal block had 18 female and 22 male patients aged 22-75. The group operated on in general anesthesia consisted of 14 female and 26 male patients aged 21-37. Mean age was 47.7 and 39.1 years in the spinal anesthesia and general anesthesia group, respectively. In the spinal anesthesia group, there were 22 ASA 1, 15 ASA 2 and three ASA 3 patients. In the general anesthesia group, there were 18 ASA 1, ten ASA 2 and two ASA 3 patients.

Results

Analysis of variable expenses of spinal anesthesia is illustrated in Table 1. The analysis included the price of all medicaments and infusions utilized in the operating theater, and the time of individual procedure. The amount of local anesthetic and fentanyl is expressed in milliliters, of midazolam and atropine in milligrams, of infusions in package units, of time in minutes, and of price in HRK. The cost of these items ranged from 33.09 to 115.49 HRK, mean 74.73 HRK.

Table 1. The cost of spinal anesthesia

n=40	Age	Needle (yrs)	Bupiva-caine	NS	Ringer	S1	S40	Infusol	D 5W	Midazo-lam IV	Midazo-lam tbl	Fentanyl	Atropine	Time (min)	Cost (HRK)
Min	22	10.8	2.5	0	1	0	0	0	1	0	0	0	1	45	33.09
Max	75	58.94	4	2	3	1	1	1	3	6	7.5	1.5	1	120	115.49
Mean	47.75	37.28	3.22	0.58	1.45	0.10	0.10	0.43	0.23	2.99	0.94	0.13	0.33	70.50	78.26*
Mean cost			4.99	4.97	12.54	1.13	4.27	3.68	2.00	2.75	0.12	0.14	0.21		*4.25 kn added
Sum		22A/18/K	128.70	23.00	58.00	4.00	4.00	17.00	9.00	119.50	37.50	5.00	13.00	2.820	
Absolute cost		1.528.36	199.49	198.95	501.70	45.20	170.60	147.05	77.85	109.94	4.73	5.52	8.45		

Table 2. The cost of general anesthesia

n=40	Age	Midazo- (yrs)	Midazo- lam IV	Atropine lam tbl	Thio-	Succinyl- pental	Vecuro- choline	Propofol nium	Fentanyl	Neostig	Ringer mine	NS	D 5W	Time (min)	Cost (HRK)
Min	20	0	7.5	1.5	400	100	6	0	3	3	1	0	0	30	49.27
Max	30	3	0	1.7	0	0	26	350	7	4	1	1	1	180	209.29
Mean	39.08	3.48	2.06	1.21	280.77	43.59	8.90	47.00	4.10	3.55	1.10	0.20	0.35	50.6	115.19*
Mean cost			3.20	0.26	0.78	2.43	0.55	32.69	8.70	4.52	10.22	9.52	1.73	3.03	* 37.65 kn added
Sum		139.00	82.50	48.30	10.950	1.700	356.00	1.880	164.00	142.00	44.00	8.00	14.00		
Absolute cost		127.88	10.40	31.40	94.83	21.32	1.307.41	347.80	180.89	408.96	380.60	69.20	121.10		

Analysis of variable expenses of general anesthesia is presented in Table 2, comprising the price of all medicaments and infusions utilized during the procedure, and the time of anesthesia. The amount of thiopental, succinylcholine, vecuronium and propofol is expressed in milligrams, of neostigmine in ampule number, and other items as in Table 1. The cost of these items ranged from 49.27 to 209.29 HRK, mean 77.95 HRK.

Both types of anesthesia have constant expenses that can be divided into common and technique specific expenses. Common material expenses are independent of the type of anesthesia and include the price of venous cannula, infusion system and ECG monitor leads, 16.30 HRK in total. The expenses specific for spinal block refer to the price of sterile gloves, 3 syringes and 3 needles, 4.25 HRK in total. The expenses specific for general anesthesia refer to the price of endotracheal tube, 2 aspiration catheters, 6 syringes and needles, and oxygen and nitrous oxide for 51 minutes of anesthesia on an average, 37.65 HRK in total.

On assessing cost difference between the two anesthesiology techniques, common material costs may but need not be added to the mean price of spinal or general anesthesia, just as the cost of energy supply or anesthesiology equipment depreciation charges are not taken into account. On the other hand, specific expenses should be included in the particular technique costs to get a correct insight into the cost difference between the two techniques. When specific expenses were added, the mean cost of spinal anesthesia was 78.26 HRK, and of general anesthesia 115.19 HRK, yielding a statistically significant difference at $p<0.01$. Figure 1 shows the two patient (anesthesia) groups according to mean

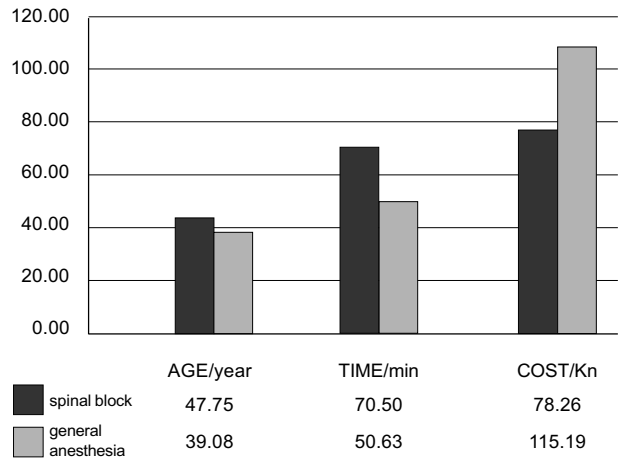

Fig. 1. Spinal versus *general anesthesia.*

age, mean time of anesthesia, and mean cost of anesthesia.

Discussion

Study results revealed spinal anesthesia to be significantly less expensive than general anesthesia in terms of material expenses, even with the predominant utilization of the more expensive atraumatic spinal needles in the former. As neither patient group experienced any major intraoperative or postoperative complications, it is concluded that both methods proved comparably safe. The more so, in line with current trends, our anesthesiologists tend to more frequently use spinal block in elderly patients and those in poor general condition, thereby successfully balancing when choosing the needle type for maximal savings at minimal risk of complications[7]. This means that atraumatic needles are primarily used in patients at an increased risk of lumbar puncture. According to patient files, there was no serious complication in either group of patients.

The fact that spinal block was used in only 40% of arthroscopic knee procedures requires special reference. The choice of technique depends on a number of factors. There is no doubt that individual anesthesiologists are more or less inclined to regional techniques, and this also holds for the patients who are always asked about the type of anesthesia they prefer[8]. The organizational and premises conditions may be even more relevant, and in case of our hospital even a limiting factor for the more common use of spinal block, because the anesthesiology department, orthopedic operating room and orthopedics department are located at three different sites. The orthopedic operating room has no appropriate room for preoperative preparation or postoperative patient monitoring, therefore patients administered spinal anesthesia stay in the operating theater for 20 minutes longer than in case of general anesthesia, as indicated in the study results. In addition to the prolonged time, maintaining circulation stability in these circumstances frequently requires intraoperative administration of colloids (Soludex), thus unnecessarily increasing the cost of spinal anesthesia. Study results indicated that spinal block was more frequently used in elderly patients, with no patient below age 20 in this group, whereas one-third of patients operated on in general anesthesia were younger than 20. This ratio has reflected the still present opinion that younger patients are more prone to the development of lumbar pucture, which actually was the case with the use of classic needles of wider diameter[1,8]. Recent studies have shown that the incidence of this complication in children is almost negligible with the use of atraumatic needles, thus the choice of anesthesia should not be influenced by the patient age[9].

Our results indicated the material expenses of anesthesia to be by 36.93 HRK lower with the use of spinal block. An inverse ratio of spinal and general anesthesia could entail savings of 1477.20 HRK only in the knee arthroscopy procedures (about 200 operations *per* year). Some 60% of operative procedures performed in spinal block should not be considered impossible to achieve in the current circumstances. Unilateral spinal block should be more frequently used to reduce the possible postoperative complications and to upgrade intraoperative stability[10].

Finally, the hypothesis of the exclusive use of atraumatic needles for spinal anesthesia should also be considered. In this case, the material expenses of spinal anesthesia would be 100.64 HRK, which is still by 14.55 HRK lower than the cost of general anesthesia. The amount of 100.64 HRK is at the same time the price plateau for spinal block, as the price of atraumatic needles is expected to fall with time. The introduction of new general anesthetics and abandoning the old ones entail an increase in the cost of general anesthesia. The cost-benefit advantage of spinal anesthesia is additionally supported by some postoperative advantages. After spinal block, our patients reported satisfactory analgesia for 2-8 hours, thus obviating at least one postoperative dose of analgesic[8] and associated savings of 2.14 to 3.41 HRK *per* spinal anesthesia, i.e. the price of 1 diclofenac-Na 75 mg ampule or tramadole 50 mg ampule, most frequently prescribed by orthopedists for postoperative analgesia.

Conclusion

The analysis of material expenses of spinal and general anesthesia in our patient sample showed spinal anesthesia with either selective or absolute use of atraumatic needles to be less expensive and clinically as safe as general anesthesia. Besides economic, spinal anesthesia is associated with well known clinical advantages in terms of lesser intraoperative and postoperative hemorrhage, and lower rate of complications in patients with metabolic impairments, and those with pulmonary, cardiac, hepatic or renal diseases[1]. Accordingly, there are both clinical and economic reasons for the more frequent

utilization of spinal anesthesia in operative procedures such as knee arthroscopy. To this end, age limitations for spinal anesthesia should be abandoned, preoperative preparation better organized, and the method of unilateral spinal block introduced to improve intraoperative circulatory stability and to additionally reduce the rate of potential postoperative complications.

References

1. BROWN DL. Spinal, epidural and caudal anesthesia. In: MILLER RD, eds. Anesthesia. New York: Churchill Livingstone, 1994:1505-33.
2. EVANS WR. Special report: complications of lumbar puncture and their prevention with atraumatic lumbar puncture needles. Conference Summaries, 52nd Annual Meeting of the American Academy of Neurology, San Diego, 2000: 52-62.
3. CORBEY MP, BACH AB, LECH K, FRORUP AM. Grading of severity of postdural puncture headache after 27-gauge Quincke and Whitacre needles. Acta Anaesthesiol Scand 1997;41:779-84.
4. GOMAR C, SABATE S, CANET J, MAYORAL V, ROIGE J, LINARES MJ, SOLER E, FERNANDEZ C. Anesthetic techniques used in Catalonia in 2003. Eur J Anaesthesiol 2005;22 (Suppl 34):113.
5. Hrvatski zavod za zdravstveno osiguranje. Odluka o izmjeni odluke o utvrđivanju liste lijekova Hrvatskog zavoda za zdravstveno osiguranje. Narodne novine 2002;57:2727-93.
6. Hrvatski zavod za zdravstveno osiguranje. Lista lijekova. 5th ed. Zagreb: Stručna biblioteka HZZO 2003:1-55.
7. ŠAKIĆ K. Spinal anaesthesia in cardiopulmonary compromised patient. Lijec Vjesn 2005;127 (Suppl 2):30-3.
8. ŠKLEBAR I, VRANKO-NAGY N, JELIĆ D, KESIĆ-VALPOTIĆ G, ŠKLEBAR D. Our experiences with spinal block. Acta Med 2000;26:76-83.
9. NOJKOV J. How to make spinal anaesthesia in children available in everyday practice. Lijec Vjesn 2005;127 (Suppl 2):11-2.
10. CASATI A, FANELLI G, BACCARIA P, ALDEGHERI G, BERTI M, SANATORE R, TORRI G. Block distribution and cardiovascular effects of unilateral spinal anaesthesia by 0.5% hyperbaric bupivacaine. A clinical comparison with bilateral spinal block. Minerva Anestesiol 1998;64:307-12.

Sažetak

MOGUĆNOSTI UPRAVLJANJA MATERIJALNIM TROŠKOVIMA ANESTEZIJE ANALIZOM RAZLIČITIH ANESTEZIOLOŠKIH TEHNIKA

I. Šklebar, N. Vranko-Nagy i D. Šklebar

Imperativ racionalizacije materijalne potrošnje u medicinskoj praksi potaknuo je autore da na modelu artroskopske operacije koljena analiziraju strukturu materijalnih troškova spinalne i opće anestezije. Cilj je bio utvrditi je li spinalna anestezija i nakon uvođenja skupih atraumatskih igala i dalje jeftinija od opće anestezije. Zanimalo nas je kako naša dnevna praksa korelira s onom u razvijenim zemljama i koje su mogućnosti racionalizacije. Retrogradnom analizom dviju usporedivih skupina od po 40 bolesnika artroskopiranih u općoj, odnosno spinalnoj anesteziji materijalni troškovi anestezije podijeljeni su na varijabilne i stalne, od kojih je dio univerzalan za obje anestezije, a dio specifičan za svaki tip anestezije. Uspoređivane su sume varijabilnih i specifičnih troškova dvaju tipova anestezije koje za spinalnu anesteziju iznose 78,26 kn, a za opću 115,19 kn. Ni u jednoj skupini nisu zabilježene značajne operacijske ili poslijeoperacijske komplikacije. Kako je od spomenutih operacija samo 40% operirano u spinalnoj anesteziji, dok je prosjek razvijenih zemalja iznad 70%, postoji dosta prostora za uštedu. Samo na artroskopijama koljena kojih se godišnje radi oko 200 uštedjelo bi se 1470 kn kad bismo postotak operiranih u spinalnoj anesteziji podigli na realno ostvarivih 60%.

Ključne riječi: *Anestezija – ekonomika; Troškovi u zdravstvu; Troškovi i analiza troškova; Anestezija – metode*