



# Cost management of general and regional anaesthesia techniques in context of quality resource management at the department of orthopaedics

NIKA PAVIĆ<sup>1</sup>  
KATARINA ŠAKIĆ<sup>2</sup>  
IVONA ŠKREBLIN KIRBIŠ<sup>3</sup>  
RANDY RICHARDS<sup>4</sup>  
MIRAN MARTINAC<sup>5</sup>

<sup>1</sup>Zagreb school of economics and management, MBA studies, Jordanovac 110, 10000 Zagreb, Croatia

<sup>2</sup>University hospital »Sveti Duh«, Department of Anaesthesiology, Reanimatology and ICU, 10000 Zagreb, Croatia

<sup>3</sup>Department of Managerial studies at Zagreb school of economics and management, Jordanovac 110, 10000 Zagreb, Croatia

<sup>4</sup>St. Ambrose University, Department of Managerial Studies, 426 Ambrose Hall, Davenport, IA 52803, USA

<sup>5</sup>University hospital »Sveti Duh«, Zagreb, Croatia

## Correspondence:

Nika Pavić  
Zagreb school of economics and management, MBA studies,  
Jordanovac 110, 10000 Zagreb, Croatia  
E-mail: pavic.nika@gmail.com

## Abbreviations:

RA – regional anaesthesia  
GA – General anaesthesia  
THR – total hip replacement  
TKR – total knee replacement  
OR – operating room

## Abstract

**Background and Purpose:** In this study the goal was to analyze costs of regional versus general anaesthesia techniques through a retrospective study. Using an interdisciplinary approach of cost management in health care institutions, independent financial analysis of costs of surgical procedures and resource utilization was conducted. The study has several aims: to emphasize benefits of regional compared to general anaesthesia, and emphasize the need for better resource allocation in order to stay competitive. Both of the aims can be summarized into one main goal, interdisciplinary approach in health care institutions must be recognized in order to organize quality (cost) management of the institution.

**Materials and Methods:** 181 patient's medical records were analyzed during different surgical procedures performed under regional or general anaesthesia. Data such as duration of operation and anaesthesia, total costs of physician and material used during the procedure, as well as anaesthesia technique were extracted from the records and elaborated.

**Results:** Ratio of regional to general anaesthesia was 61%:39% in the observed 4 month period. Average total cost of regional anaesthesia operation, calculated from the surgical lists for the observed four month period, was 11,6€, while average total cost of general anaesthesia was 44, 8€. Thereby costs of anaesthesia technique were lower ( $p < 0,01$ ) for regional anaesthesia. Both material and medication costs showed statistically and clinically relevant difference, since they were significantly less in regional anaesthesia group ( $p < 0,01$ ).

**Conclusion:** Study showed clear economic benefits of regional anaesthesia compared with general anaesthesia. It was concluded that regional anaesthesia indeed does have lower costs than general anaesthesia. Great discrepancy between physicians' salary and the salary they actually earn by spending specific amount of time working in the OR suggest poor resource utilization.

## INTRODUCTION

Health care management differs significantly from the field of general management; however its key components for achieving competitive advantage are not different: cost rationalization and proper allocation of resources, managed by qualified professionals within the health institution. In light of financial constraints and new approaches that threaten traditional organizational structures, health institutions

are under pressure to embrace the interdisciplinary approach in healthcare institutions in order to maximize the quality of service. Like any other institution, they tend to seek maximum job performance with lowest costs possible, while maintaining high professional standards.

Skilled resource management is an important factor in any health care institution. It is important to reduce utilization of particular resources, where possible, but never at the expense of a patient. Exaggerated and needless resource utilization should be avoided. For example, patients with same diagnosis can use a wide spectrum of remedies which can then contribute to exaggerated expenses for the hospital. Wise resource stewardship dictates identifying and using remedies proven effective in terms of both cost and patient care. The final goal of cost management is continuous cost reduction with a higher rate of procedures performed on patients, and finally larger profits of a health care institution. Successful management requires skilled resource allocation and utilization, while striving to get all the work done within agreed costs, or if possible less than agreed, so it leaves more funds in the end. The study is divided on two specific areas of interest. First the study examines the cost's associated with regional and general anaesthesia including possible benefits of regional anaesthesia (RA) compared to general anaesthesia (GA). The second part of the study examines the specific application of these two anaesthesia techniques in cases of hip and knee replacement surgeries. Based on a review of both these areas, the study suggests benefits of regional versus general anaesthesia in specific instances. Based upon certain research, general anaesthesia is direct cause of death in 1 of 10,000 operations. Data obtained from perioperative death case reports are fairly difficult to analyze since they usually represent a combination of anaesthetic and operative factors. Frequency of morbidity as a result of induction of anaesthesia is even harder to establish (1). Another focus of the study was resource utilization within the hospital, which was analyzed using the approximate wage of physicians. In light of current socio-economic situation worldwide, results obtained analyzing the above mentioned fields of hospital finances is expected to serve as a tool for continuous cost reduction and monitoring in order to prevent sharp cost reductions (2). In light of cost management within health care institutions, the study attempts to answer the following questions:

1. Which anaesthesia technique provides greater »return on invest« in terms of educating and training physicians in specific technique, while in the same time presenting a better choice in terms of patient safety?
2. What are the costs of inefficient use of certain resources, e.g. maximization of physician's working hours and minimizing »idle time« within operating room, in terms of patient safety and hospital finances?

These hypotheses that were tested:

- H1: Lower percentage of RA in comparison to western hospitals' standards indicates possible need for

additional education in order to develop adequate expertise and increase physicians' confidence while performing RA.

- H2: Significant potential complications associated with GA are more serious and severe in comparison with RA complications.
- H3: Discrepancy between formal wage of physicians, and wage earned based upon number of hours actually spent working suggest inefficient resource utilization.
- H4: RA and GA cost comparison shows an undeniable economic advantage of using RA instead of GA, whenever possible
- H5: Subjective blood loss assessment during hip and knee replacement surgeries is likely to result in additional (unnecessary) costs for both RA and GA technique.

## Overview of anaesthesia techniques used during data processing of medical records for 2010

### General anaesthesia

General anaesthesia (GA) is the state produced when a patient receives medications for amnesia, analgesia, muscle paralysis, and sedation. An anaesthetized patient can be thought of as being in a controlled, reversible state of unconsciousness (3). During GA all of patient's vital functions are under control in order to keep his organism functioning during the whole surgery, with aid of medications and other methods. Anaesthesia enables a patient to tolerate surgical procedures that would otherwise inflict unbearable pain, potentiate extreme physiologic exacerbations, and result in unpleasant memories (4).

### Regional anaesthesia

Regional Anaesthesia is a method of pain prevention for surgeries and procedures. Instead of making the patient sleep through surgery, the area of the body that would feel pain is numbed, allowing the patient to have the procedure while awake. One benefit of a regional anaesthetic is the patient can be sedated or be fully conscious. A C-section is an example of a procedure performed with the patient awake, with regional anaesthesia (epidural) used to control the pain of the surgery. This type of anaesthesia is provided by injecting specific sites with a numbing medication that works on the nerves of the body, causing numbness below the injection site (5).

### Use of anaesthesia in orthopaedic surgeries

Orthopaedic surgery can be done using a number of different anaesthetic options; however, not all options are available in all patients for all procedures. General anaesthesia is the most commonly used anaesthesia for most major orthopaedic procedures. However, studies have proven RA has lower incidence of intraoperative and postoperative complications compared to GA (6). RA has a wide application in orthopaedic surgery. It can

be used as an adjunct pain relief therapy or as an analgesic during surgery. Providing many benefits to patients, including improved pain control and faster recovery times, regional anaesthesia is now being incorporated regularly into many surgical treatment plans (7). More specifically, RA was proved to be useful in many different types of procedures, such as hip and knee replacement.(8) Since there are more and more patients who undergo knee replacement surgery at a younger age, it is essential to ensure the patient starts with physical therapy shortly after the procedure, so he could return to his everyday activities as soon as possible (9). A femoral nerve block can be especially effective in this context. This type of anaesthetic is used as supplement to the therapy by insertion of femoral nerve catheter, allowing the patient long lasting postoperative pain relief. During a procedure, spinal anaesthesia is used for primary pain control (10). Compared to general anaesthesia, spinal anaesthesia has several benefits, including less blood loss during surgery due to lower arterial and venous pressure, maintained blood circulation — which reduces the rates of deep vein thrombosis in the lower extremities — and reduced infection rates. Patients are much more alert after surgery and have a much lower incidence of postoperative nausea. It is also used as an adjunct pain relief therapy or as an analgesic during surgery. Other patient benefits of regional anaesthesia include an earlier hospital discharge and an improved ability to tolerate physical therapy after surgery (11).

## MATERIALS AND METHODS

This research for this study took place during four month period from March 2010, to June 2010. Key data gathered from medical records to form a cost benefit analysis include diagnosis, duration of anaesthesia, duration of surgery, cost of anaesthetic, form of anaesthesia, other material costs, final price of the specific anaesthesia technique, and cost of blood transfusion. Each of those datum was chosen with the specific aim of conducting a quality economic analysis. Examining a specific preoperative diagnosis created a connection between final cost and specific diagnosis as well as demonstrating which preoperative diagnosis had highest labour and material cost. The duration of both anaesthesia and surgery was helpful in determining the severity of illness, but also level of knowledge and competence in specific procedures (especially those where there is a significant difference in duration of a procedure in different patients with the same preoperative diagnosis). Cost of antibiotic and trombotrophylaxis, fluids and other materials represents another important economic aspect in terms of preventing infections and other unintended consequences of surgery, thus reducing extra costs of hospitalization.

The study included 181 patients of all age groups who underwent elective orthopaedic surgeries during four month period, from March until June 2010. Selected subjects were classified according to their diagnosis. Cases with insufficient amount of data were excluded from the study. However, cases where there was no informa-

tion of duration of the procedure were included in the analysis, since that information was not essential for the overall analysis. Observed anaesthesia techniques were GA and RA, in terms of spinal, epidural, regional block and local anaesthesia. For induction of general anaesthesia the following anaesthetics were used: propofol, hypnomidate and fentanyl. Isoflurane and sevoflurane were used to maintain the anaesthesia. RA was induced using local anaesthetics such as marcain, lidocain and chirocain. Perioperative data such as ASA classification of patients, incidence of hypotension in spinal anaesthesia, blood transfusion during surgery and other possible complications were taken into account in the final discussion and results, even though they were not consistently recorded on each medical record. Data regarding blood transfusion was valuable information from economic aspect, since subjective assumptions were made regarding required blood doses for surgical procedures.

As for the resource utilization, the average wage of a physician (excluding night calls, weekends and bonuses) was considered, based on his contracted income. Based on the Department's medical records the study calculated the number of hours spent in the operating room the real (earned) wage for each physician. Although many different anaesthesiologists changed in the operating room on the daily basis, in order to simplify the final calculation, we assumed only one physician (anaesthesiologist) worked in the operating room during any single working day.

## STATISTICS

Statistical analysis was performed using the SPSS software programme. P value <0.05 was considered statistically significant, although values slightly greater than 0.05 (e.g. 0.06) were considered as marginally significant, or significant if the level of confidence were 90%. Table 2 presents descriptive statistics for costs in hip and knee replacement surgeries. P value in this case is less than 0,0001, which gives us enough evidence to reject the null hypothesis, and say there is a statistically significant difference between the two sample means based on the 95% level of confidence.

## RESULTS

The study protocol was approved by University hospital »Sveti Duh«, Zagreb. All data were entered and processed in Excel spreadsheet. During observed four month period the ratio of times each anaesthesia technique was used is 110:71 (RA-61%; GA-39%). This indicates very high proportion of GA, if we take into consideration western countries have much higher percentage of RA, usually around 70–80% of the cases.(12) Average cost of RA (including primarily material and medication, without labour and blood transfusion included) obtained from the surgical lists for the observed four month period, was around 11,6€. Average cost of GA was around 44, 8€. The average costs were calculated by adding material and medication costs for each operation from the

TABLE 1

Overview for departmental use of different anaesthetic techniques for March – June 2010

	Orthopaedic anaesthesia	Urology anaesthesia	ENT anaesthesia	Surgical anaesthesia	Obgyn anaesthesia	ER
GA	87 (35%)	167 (65%)	348 (99%)	1226 (88,9%)	292 (41%)	213
RA	161 (65%)	90 (35%)	1 (1%)	153 (11,1%)	420 (59%)	
Total number of the procedures	248	257	349	1379	712	

medical records. This has been done separately for each anaesthesia technique. Less than 10 cases had to be excluded from the study, based on lack of data such as operating time and anaesthesia duration, as exclusion criteria. Table 1 explains departmental use of regional and general anaesthesia techniques, in order to give a general overview. Figure 1 shows prevalence of specific preoperative diagnoses in orthopaedic surgery during March, April, May and June 2010 procedures performed either in RA or GA. Figure 2 explains representation of RA for the Department of Orthopaedics, which is 61%, while percentage of RA is 39%. The average budget of orthopaedic anaesthesia is 1747€, and in our case we have 110 procedures performed in RA (with the average price of 11,64€) and 71 in GA (with the average price of 44€), hence the approximate budget for orthopaedic anaesthesia for the observed four month period was 6986,3€. Average cost of RA was approximately 174€, and average cost of GA was 426€, both during the observed four month period. This leads to a conclusion that total costs of RA and GA constitutes 62% of the specified budget for the observed time

period. The average budget for orthopaedic anaesthesia in four month period was 6989€, and costs for RA and GA for the period from March until June 2010 are 4397€, i.e. 62% of the specified budget.

Characteristics of the data gathered from the medical records are shown on Table 2 which presents descriptive statistics for all the examined data. Some of the parameters, such as anaesthesia and operation time, show very little or no difference in the mean, which indicates there is probably very little or no significant difference between patients (i.e. procedures). High standard deviation is observed in total cost (RA = 186,19; GA = 252,32) and blood transfusion data sets (RA = 134,48, GA = 196,45). This indicates much variation from the average and indicates possible inconsistency in expenditures on medication and blood transfusion. Figure 3 explains subjective assessment of blood loss during orthopaedic during surgery, made by anaesthesiologist.

Table 2 shows there is no statistically significant difference between two anaesthesia techniques when duration of the anaesthesia is observed (P=0,995). Blood transfusion cost during THR and TKR does not assume equality of variances (P = 0,88). According to the t-test analysis there is not enough evidence to claim that costs of blood transfusion are higher in either anaesthesia techniques (P = 0,437). This suggests that blood transfusion as a parameter is not indicative for either RA or GA. Statistical data obtained for total cost of blood transfusion, labour, medication and material assumes indicates significantly higher costs for GA induction (P<0,01). Statistical data for duration of operation does not assume equality of variances, therefore one can conclude the means of operating times for RA and GA do not differ

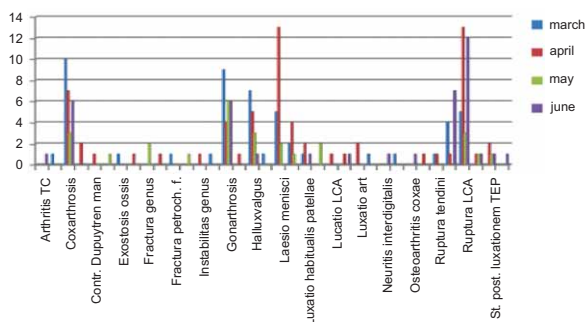


Figure 1. Bar chart of prevalence of specific preoperative diagnoses in orthopaedic surgery during March, April, May and June 2010

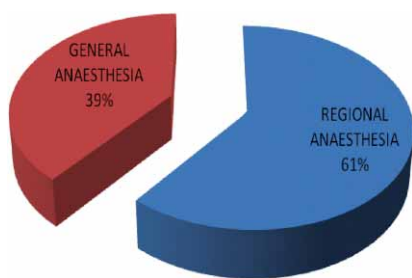


Figure 2. Pie chart of comparison of regional and general anaesthesia in orthopaedic surgeries during the observed four month period.

Perioperative blood loss assessment according to blood transfusion records

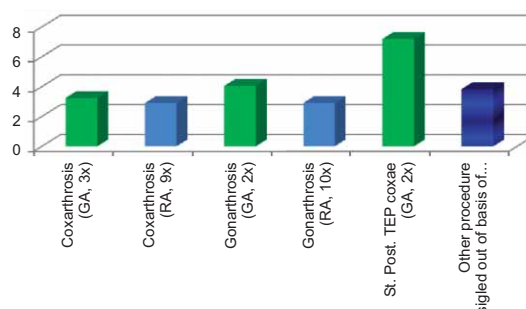


Figure 3. Bar chart presenting subjective assessment of blood loss during surgery, made by anaesthesiologist.

TABLE 2

Descriptive statistics presenting cost management of general and regional anaesthesia techniques through data obtained from the medical records. Duration of anaesthesia and operation were calculated in HRK, while measurement unit for blood transfusion was ml. Other costs were also calculated in HRK.

	Anaesthesia techniques in orthopaedic surgery	N	Mean	Std. Deviation	Std. Error Mean	t
Duration of anaesthesia	Regional A.	101	106,7327	44,85976	4,46371	,006
	General A.	64	106,6875	52,73951	6,59244	
Blood transfusion during total knee/hip replacement	Regional A.	119	62,9269	134,48218	12,32796	-,778
	General A.	68	81,8284	196,45059	23,82313	
Total cost (including material and medication, blood transfusion and physician cost)	Regional A.	101	217,1860	186,19749	18,52734	-6,761*
	General A.	64	448,5826	252,35334	31,54417	
Duration of surgery	Regional A.	105	74,2476	37,07549	3,61820	-,429
	General A.	64	77,0313	46,65577	5,83197	
Material and medication cost	Regional A.	114	91,1616	57,08991	5,34696	-16,437*
	General A.	68	310,7154	122,14902	14,81274	
Physician cost	Regional A.	105	59,8065	29,86431	2,91446	-,429
	General A.	64	62,0487	37,58122	4,69765	

\*p<0,05

greatly ( $P = 0,686$ ). Total cost of medication and material indicates significantly higher costs for GA ( $P < 0,01$ ), which can also be observed from the means of the mentioned data (RA = 91,16; GA = 310,71). Cost of physician does not indicate clinically significant difference between RA and GA procedures ( $P = 0,686$ ).

Table 3 presents salaries physicians actually earned, during the four month period, by working in the OR.

Considering the average wage of specialist in anaesthesiology is 1,164 € (night calls, weekends, physician's duties and bonuses are not included) minimal nominal wage was calculated, based on his contracted wage. The result obtained for March presents real earnings of a physician during the observed month. This value presents actual efficacy of a physician expressed in terms of money. If we put in relation the average wage of a doctor specialist, with monthly income of 1164 €, and average wage with monthly income obtained from medical records we come to an interesting conclusion. Namely, when we divide 1164 with 22 work days we get 36,8 €. When 809,8 € is divided by 22 work days, we get 35,6 €. If we put the number in relation, we will see that the doctor specialist

actually earned only 69,5% of the amount he was paid. In April doctor specialist earned 68,25% of his nominal income on the basis of work in the orthopaedic operating room. In May, he actually earned only 23,4% of the salary he received for that month. In June, according to obtained medical records from the department of anaesthesiology, doctor earned 67,7% of the amount he was actually paid at the end of the month. That imposes the conclusion of irrational utilization of human resources. This could mean no optimal OR schedule was created, with too much »idle time« between two procedures, which results in underutilized doctors and finally opportunity cost – not using the OR in most efficient way.

## DISCUSSION

If an assumption was made that 90% of surgeries were performed in RA, and only 10% in GA the result would be shown by Figure 4. In this case 163 procedures would have been performed in RA, and 18 in GA, and the ratio would be as shown on the Pie. Average cost of RA in this case would be 1898€, and average cost of GA would be 789€, delivering the sum of 2687€, i.e. 38% of the budget

TABLE 3

Incomes actually earned by physicians during four month period. All the financial data was expressed in both HRK and Euro, for comparison with international standards.

	March	April	May	June
Nominal earnings of a doctor specialist	8500 kn (cca. 1164 €)	8500 kn (cca. 1164 €)	8500 kn (cca. 1164 €)	8500 kn (cca. 1164 €)
Real earnings of a doctor specialist	5911,46 kn (cca. 809,78 €)	5802,02 kn (cca. 795 €)	1989,96 kn (cca. 276 €)	5752,53 kn (cca. 788 €)
Ratio of nominal and real earnings	69,5%	68,25%	23,4%	67,7%

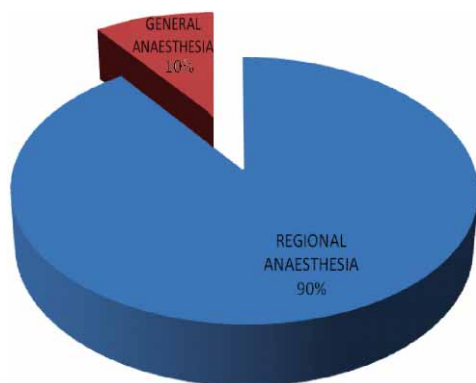
for orthopaedic anaesthesia for the four month period. From the enclosed we see that this ratio would be much more suitable in terms of financial resource utilization, since it would leave more room for expenditures on other procedures and means at the Department. This ratio would also help the hospital to save 1710€.

In context of cost rationalisation it is necessary to mention the cost of blood transfusion. Medical records for March until June, obtained at Clinical hospital »Sveti Duh«, Department of orthopaedics, show the perioperative blood loss was not systematically recorded, which leads to a conclusion that blood transfusion was given upon subjective assessment of the physician. From medical point of view, allogeneous blood may cause allergic reactions, viruses and infectious diseases, lung injury as well as different kinds of haemolytic reactions. Therefore, auto transfusion may be a good substitute for allogeneous blood, since it is an ideal match and is more readily received by the patient's body. Apart from that, the process of auto transfusion includes reduced risk of infection and better functioning of cells (13). Since the blood is a perfect match it allows quicker recovery of the patient, which leads to reduced costs of hospitalization and better cost rationalisation. Economic – wise auto transfusion has many advantages, all leading to the same result – reduction of hospital costs. Possible infection of a patient during blood transfusion means additional treatment costs for the hospital, not to mention the loss of credibility which could result in losing the competitive advantage on the market.

In context of physicians' salary and their effectiveness it should be noted that terms »nominal wage« and »real wage« in this text do not refer to the well known economic definition of real wage and nominal wage. In economy, term real wages refers to wages that have been adjusted for inflation. This term is used in contrast to nominal wages or unadjusted wages. Real wages provide a clearer representation of an individual's wages (14). However, here we used those terms only to explain the distinction between so called nominal wage, or the one determined by contract, and real wage which serves as term for the income a worker has really earned by performing his tasks in a certain period of time. From the re-

sults obtained from medical records for four month period, data for May clearly stands out. While the remaining three months have similar results, round 800 €, calculation for May differs significantly. One of possible reasons could be lack of data for certain dates; the procedure itself was recorded, but there is no entry of the duration of a procedure. Furthermore, some dates were excluded from the records. Therefore, we can assume that surgeries were performed on the dates excluded from the medical records, since those are work days (and waiting lists for patients are long enough not to allow any idle time), but since there is no data of such procedures it is difficult to draw a conclusion about the duration, cost and any sort of procedure performed that day. Obtained results can be used as guidelines for more efficient case scheduling and maximum staff utilization, on order to avoid »idle time« in operating rooms. This could be achieved by booking cases without having to wait, i.e. minimizing the wait for procedures while covering all emergency cases and without overextending the operative team (15). This type of rationalization could have a positive impact on national waiting lists. Seemingly over-utilized capacities on certain dates, when the recorded work day lasted more than 10 hours, does not necessarily point to positive resource utilization, but mostly to work in double shifts, or possibly flawed organization in terms of time and resource allocation. This is evidenced by a fact that on certain workdays there is lower utilization rate of room capacity. Discrepancy in results obtained in this study indicates the need for better time management in terms of reorganization of resources (16).

Economic benefits of RA over GA have been clearly presented in this study, which is in accordance with studies conducted by many foreign authors dealing with issues of regional anaesthesia and its medical and economic aspects. From medical aspect RA offers advantages such as decreased postanaesthesia care unit use, nausea, and postoperative pain, which are all arguments in favour of regional anaesthesia. Lower mortality and morbidity is definitely a good indicator of the benefits RA has over GA. However, some authors point out unchanged number of complications with RA, while technological progress is causing profound changes in GA in terms of lower mortality and progress in general. Positive impacts of RA in patient treatments have been discussed on several occasions in journal »Anaesthesia Analgesia«. In the issue *AnesthAnalg 2005;101:1631–3* MD Amir Hadžić discusses benefits of RA over GA in his article »Is regional anaesthesia really better than general?«. In his study doctor Hadžić notes that the use of peripheral nerve block has significant benefits over central nerve block or general anaesthesia, and his arguments are also confirmed in research made by Liu SS, Strödtbeck WM, Richman JM i Wu CL in their meta analysis of randomized clinical trials. It is stated that the use peripheral nerve block allows much more comfortable recovery for the patient, with less nausea, vomiting and postoperative pain in comparison to general anaesthesia, as well as shorter hospitalization and increased patient satisfaction



**Figure 4.** Ratio of RA to GA if only 10% of orthopaedic surgeries were performed in GA.

(17). However, the main issue in that study, which matches the arguments of our study, is need for high quality education in the field of regional anaesthesia; the quality of used anaesthesia technique, such as peripheral nerve block, is questionable unless it is performed by appropriately educated professional. A specific example is a study that showed two completely different results obtained during induction of intrascapular nerve block in shoulder surgery: in one study, the use of this nerve block did not result in successful anaesthesia with more than 82% of patients, while other studies had a 100% success for the same indication. An important issue of anaesthesia is that it is being practiced (with success) by relatively small number of professionals that invested most of their lives in mastering techniques of regional anaesthesia. The future of this specialisation has to be in standardization of RA procedures, objective documentation and obtaining quality results of clinical trials in order to help the doctors to determine best practices for cases in which RA has clear advantages over other anaesthesia techniques (18).

Regional anaesthesia clearly requires special skills, along with the use of latest technology, but also it requires dedicated work on improving the patient safety and reducing possible medical errors. This leads to a very important issue, from economic aspect, which is team work. Cost benefit analysis is just one part of a greater whole which refers to cost management and general management. Cost management implies wise decision making regarding the development of sources of funds and the efficient use of funds which is fundamental to achievement of the economic goal of any business (19). A wise strategic planning and financial management, along with a strong sense of unity among medical staff, in terms of team work, ensures lower incidence of medical errors and high quality service for the patient. An important tool for achieving these results is Surgical Safety Checklist which can cause reductions in the rates of death and complications among patients. Every country and hospital should implement such lists in their work, with necessary adjustment, in order to maximize its job performance. Utilization of capacities is another issues that requires interdisciplinary approach. It is important to maximize the number of surgical cases that can be done on a given day while minimizing the required resources and related costs. Ideally, good resource utilization should ensure patient safety and optimal patient outcome, provide surgeons with appropriate access to the OR so that patients can have operations in a timely manner, maximize the efficiency of staff, and materials, enhance satisfaction among patients and decrease patient delays. Incremental improvements in resource utilization and improved efficiency can have major impacts on hospital staff and finances, maximizing its profit (20).

## CONCLUSION AND RECOMMENDATIONS

By interdisciplinary approach used in this study, we tried to point out to certain obstacles physicians encounter while performing their tasks, which could easily be overcome by integrating economics into medical and

health institutions management. The framework of this study was to show the benefits of using RA instead of GA, where possible. Apart from the obvious medical benefits of RA, such as shorter hospitalization and need for postoperative care, reduced postoperative pain and need for postoperative analgesia, reduced intraoperative complications, it is important to stress out the economic benefits of this anaesthesia technique. Use of RA reduces the need for postoperative analgesics, which then reflects in lower drug procurement costs. Furthermore, shorter duration of hospitalization enables rational resource utilization, thus increasing patient frequency at the post-anaesthesia care units (PACU) and decreasing costs of individual patient treatment, if the patient has been safely discharged in short term (21).

To adequately conclude this study, it is important to give not only arguments, but also guidelines for everyday medical practice. In all of the above mentioned practices and cases it is important to have a well planned strategy has to include both short-term and long-term horizon of missions. Long-term strategic plans are those that list the major environmental issues the organization may face over the next several years describing how it intends to respond. One of the most important tools for achieving competitive advantage on the market is **benchmarking** (22). Benchmarking is term used for the process of determining who is the very best, who sets the standard, and what that standard is. It can help an organization discover who performs the business process very well and has process practices that are adaptable to your own organization, Who is the most compatible for them to benchmark with (23). This is a good way to help a hospital to identify and learn how best-in-class hospitals achieved excellence. Besides benchmarking, there are other tools available for improving and assessing quality, such as TQM program. TQM is a comprehensive and structured approach to organizational management that seeks to improve the quality of products and services through ongoing refinements in response to continuous feedback. TQM processes are divided into four sequential categories: plan, do, check, and act (the *PDCA cycle*). In the *planning* phase, people define the problem to be addressed, collect relevant data, and ascertain the problem's root cause; in the *doing* phase, people develop and implement a solution; in the *checking* phase, people confirm the results through before-and-after data comparison; in the *acting* phase, people document their results and inform others about process changes (24). In order to benefit from above mentioned economic tools it is important to have a solid knowledge base which would enable implementation of those tools: a good working climate and well structured policies within the organization help implement and utilize new strategies in order to maximize job performance and efficiency.

## REFERENCES

1. LI G, WARNER M, LANG B H, HUANG L, SUN L S 2009 Epidemiology of Anesthesia-related Mortality in the United States, 1999–2005. *Anesthesiology* 110: 756–765

2. BYA ISRAELSSON, WILLENHEIMER R B, K BROMS, ERHARDT L R, CLINE C M J 1998 Cost effective management programme for heart failure reduces hospitalisation. *Heart* 80: 442–446
3. Patient.co.uk Retrieved on February 15<sup>th</sup> 2011 from <http://www.patient.co.uk>
4. YENTIS S, HIRSCH N, SMITH G 2009 Anaesthesia and intensive care A–Z: An encyclopedia of principles and practice. Churchill Livingstone.
5. RILEY E T 2003 Regional anaesthesia for cesarian section. *Techniques in Regional Anaesthesia and Pain Management* 7: 294–212
6. URWIN S C, PARKER M J, GRIFFITHS R 2000 General versus regional anaesthesia for hip fracture surgery: a meta-analysis of randomized trials. *British Journal of Anaesthesia* 84: 450–455
7. KHANDURI K C 2008 Regional anaesthesia techniques for orthopaedic surgery. *Medical Journal Armed Forces India* 64: 108–110
8. FRANCOIS S, CAPDEVILA X 2001 Regional anaesthesia for orthopaedic surgery *Current Opinion in Anaesthesiology* 14: 733–740
9. Arthfound.org Retrieved on March 10<sup>th</sup> 2011 from <http://www.arthfound.org>
10. REES G, MATHUR D 2009 Regional blocks in orthopaedics. *Anaesthesia&Intensive care medicine* 10: 22–25
11. Surgery.about.com Retrieved on March 19<sup>th</sup> 2011 from <http://surgery.about.com>
12. SCHUSTER M, GOTTSCHALK A, BERGER J, STANDL T. A 2005 Retrospective Comparison of Costs for Regional and General Anesthesia Techniques. *Anesthesia&Analgesia* 100: 786–794
13. MENAHEM A, DEKEL S H *et al.* 2003 Comparative analysis of the benefits of autotransfusion of blood by a shed blood collector after total knee replacement. *Archives of orthopaedic and trauma surgery* 124: 114–118
14. MOHAMMADI H 1993 Nominal-wage contracts and real activity: evidence from the German economy. *Southern economic journal* 60: 97–97
15. GABLEL R, KULLI J, LEE S B, SPRATT D G 1999 Operating room management. Butterworth-Heineman.
16. TAYLOR R J, TAYLOR S B The AUPHA manual of health services management. Aspen publishers.
17. HADZIC A 2005 Is Regional Anesthesia Really Better than General Anesthesia? *Anesthesia&Analgesia* 101: 1631–1635
18. LIU S S, STRODTBECK W M, RICHMAN J M, WU C L 2005 A Comparison of Regional Versus General Anesthesia for Ambulatory Anesthesia: A Meta-Analysis of Randomized Controlled Trials. *Anaesthesia&Analgesia* 101: 1634–1642
19. PORTER M E 2004 Competitive advantage. Free Press.
20. ABOULEISH A E, DEXTER F, EPSTEIN R H, LUBARSKY D A, WHITTEN C W, PROUGH D S 2003 Labor Costs Incurred by Anesthesiology Groups Because of Operating Rooms Not Being Allocated and Cases Not Being Scheduled to Maximize Operating Room Efficiency. *Anesthesia&Analgesia* 96: 1109–1113
21. ŠAKIĆ K 2007 Regionalna anestezija i analgezija. Naklada Ljivek.
22. THOMPSON A A JR., STRICKLAND A J, JOHN E. GAMBLE 2008 Strategic management, MATE.
23. WIMERSKIRCHA, GEORGE S 1998 Total Quality Management: Strategies and Techniques Proven at Today's Most Successful Companies. Wiley.
24. SPENDOLINI M J 1992 The Benchmarking book. Amacon books.