



Could the choice of regional anaesthesia serve as a cost management indicator within a hospital?

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Summary

Application of certain economic knowledge and skills in the medical field could help improve organization and functioning of certain hospital departments. By analyzing the use of certain anesthesia techniques, bearing in mind cost benefits of using regional anesthesia, along with benefits for the patient (lower postoperative pain and more effective postoperative pain relief) we will try to demonstrate the benefits of regional anesthesia in comparison to other anesthesia techniques.

The purpose of the data presented in this paper is to illustrate the importance of interdisciplinary approach for achieving optimal quality of medical service and patient satisfaction. The analysis of the reports from University hospital "Sveti Duh" Department of Anesthesiology, reanimatology and Intensive medicine indicates how the use of a particular anesthesia technique can contribute to the rationalization and identify key segments of a business process where there is room for improvement.

INTRODUCTION

When analyzing the costs of health care, it is important to underline that the analysis of production costs in any of the activities is one of the most important economic item (1). What represents a great obstacle to the cost analysis in health care sector is the fact that this is the sector whose institutions produce more than one product concomitantly. Thus, there is a certain consensus that hospitals generally produce a wide array of products which are not often precisely defined. In health care economy it is important to extend the scope of consideration from exclusively economic side to the medical aspect of specific problems and issues (2). In other words, although general economic principles apply in health care, additional phenomenon not characteristic for general economic principles are also to be taken in consideration. Not only production processes in health care sector generate more products, time is another important factor as each patient may receive several health services during a period of time, i.e. he/she would probably contact several health care institutions related to his/her medical problem (for example, laboratory, primary health care, specialist-consultative services, etc.). In order to anticipate the quantity and type of the delivered goods, factors such as age of the patient, intervention he/she is subject to, complexity of intervention, etc. are also relevant (3).

In order to minimize costs and/or maximize production, the hospitals should select combination of services which are optimal both from

economic and medical aspect. Since the state budget for health care is fairly limited, the health institutions management is responsible for efficient allocation of resources with optimal usefulness for community. However, it needs to be repeated that optimal implementation of health care services for the patient means the way medical procedures have been implemented, not the quantity there of (4).

The use of certain anesthesia techniques is one of the key factors in the hospital costs management since this procedure is performed in the majority of hospital departments and thus can not be considered as a separate department or business process within the hospital structure. It has been proved that the use of regional anesthesia is more acceptable method than the others but since it requires a higher level of expertise and continuous education of specialists it represents higher costs for hospitals (5-7). It is recommended to make a comparison with foreign hospitals in which a share of regional anesthesia is justifiably much higher than that of other techniques. This implies that one-off higher costs invested in the education of experts in this field generate long-term benefits both for the hospital budget and for a central figure in the health system – the patient (8).

ANALYSIS AND METHOD OF WORK

The analysis has been conducted based on the collected data from the Report on Procedures for 2012. The Report provides the description of specific anesthesiology techniques used in individual hospital departments, total number of interventions carried out under particular anesthesia technique and total number of such intervention by departments. In addition to this, the analysis of the data under Tables showing groups of techniques used in the process of regional anesthesia, provided the percentage of regional anesthesia as against general anesthesia by individual hospital departments. The data have been collected by authorized personnel from each department and prospective survey has been performed based on selected indicators for 2011. The data are sorted in forms foreseen for annual reports. Such analysis is useful for realizing one's own position in the context of the expertise of the department's anesthesiologists but also for comparison with the international standards – share of regional anesthesia compared to general anesthesia and compared with international standards (ratio of the use of regional as against general anesthesia of approximately 70%:30% abroad is deemed to be reasonable).

STATISTICAL ANALYSIS

In order to obtain P value In the statistical processing t-test has been performed for making comparison of the two known arithmetic means of two independent samples (patients who were administered regional and general anesthesia). The difference in arithmetic means is based on confidence interval (CI) of 95%. It has been concluded that when P value is less than 0.05, there is a significant statistical deviation between the observed arithmetic means of the samples. By means of descriptive

statistics shown in Tables 1, 2 and 3 the arithmetic means values, standard deviations, interquartile range and the coefficient of variation have been calculated by the insertion of non processed data. On the other hand, inferential statistics has been used for offering the explanation of the situation and to provide certain conclusions about the groups of samples (9).

P value of 0,64 in Table 1 may be explained as marginal significance as, if we set confidence interval to 90%, the value would really be statistically significant. We may say that there is no enough proof to reject the alternative hypothesis, therefore, we can reject the null hypothesis and conclude that arithmetical means for regional and general anesthesia are equal ($H_0: \mu_1 = \mu_2$). Although, we do not have enough proof to reject alternative hypothesis this still does not mean that there exists high clinical or scientific significance. This also means that in case that there is no statistical significance we should not immediately reject the importance of the data obtained.

Since the result of this paper has shown marginal significance we may conclude that, to obtain better and more accurate assessment, the testing of a higher sample is necessary.

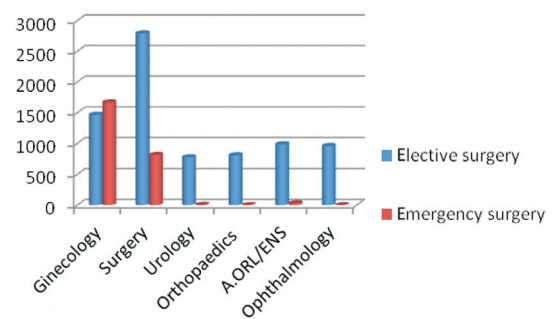


Figure 1. Overview of performed emergency and elective surgical procedures during the year 2012.

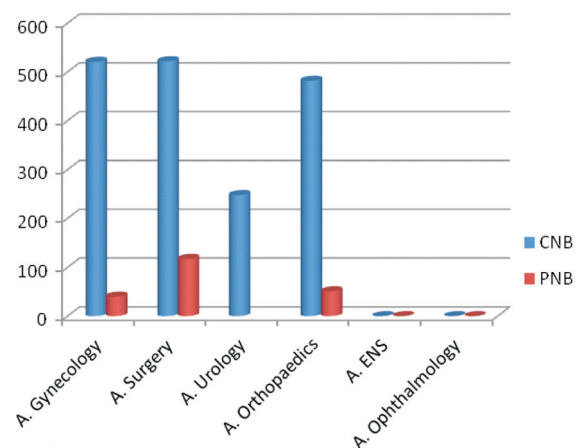


Figure 2. Overview of surgical procedures by different hospital departments performed in central nerve (CNB) block and peripheral nerve block (PNB), during year 2012.

TABLE 1

Descriptive statistic for costs of anesthesiology techniques (general (GA) and regional (RA) spinal (in HRK)- based on the data on expenditure of material obtained from anesthesiology lists for the four- months period in 2010.

Anaesthesia technique	Arythmetic mean	Mode	Interquartile /IQ	Variance	Standard deviation	Coefficient of variation	Variability	P value
GA	793,18169	332,44	125,125	14714896	3835,9994	483,621847	moderate	0,064
RA	101,3864	107,085	60,4476	3071,603	55,422049	54,66414835	large	

TABLE 2

Descriptive statistics for cost of hip and knee replacement surgery (in HRK) obtained by gathering data on resource utilisation for the four month period in 2010.

Anaesthesia technique	Arythmetic mean	Mode	Interquartile /IQ	Variance	Standard deviation	Coefficient of variation	Variability	P value
GA	360,154444	358,25	229,48	23116,02	152,039519	42,215089	moderate	>0,0001
RA	121,634762	111,1	43,32	2983,876	54,6248651	44,9089259	moderate	
BLOOD TRANSFUSION	352,446364	244,9	213,3	34752,33	186,419771	52,8930896	large	

RESULTS AND COMMENTS

The results of data collected prospectively are best shown in tables which show that the highest percentage of regional anaesthesia – even 46% is performed in gynecology departments (logically as epidural and spinal anaesthesia are often used) and in orthopedic departments where it amounts to 66%. In urology departments a share of regional anaesthesia is 43% and in surgical JIL only 18% of interventions are performed under regional anaesthesia (10–16).

The results of analysis aimed at improving the frequency of all emergency and elective surgery in University hospital Sveti Duh are shown in Figure 1.

A retrospective study of blood transfusion data according to medical records for period March – June 2010 was conducted by the Clinical Hospital "Sveti Duh", Zagreb. The study was undertaken to determine how blood transfusion costs affect the overall cost policy and cost management of the health care institution. Emphasizing the benefits of using autologous transfusion as a safer alternative to homologous transfusion was one of the main focuses. Records of thirty-five patients undergoing different orthopaedic surgery were used for measurements. Patients were randomized into groups according to the preoperative diagnosis (either THR or TKR). Since there was no data on the actual blood loss during the procedure, all the calculations were done according to blood transfusion records.

Although we cannot say a specific correlation was noticed between most of preoperative diagnosis and blood transfusion records, hip revision surgery was the operation with highest blood transfusion per minute, 7,19 ml/min. Other procedures required average of 3,5 ml/min of blood. The average cost of blood transfusion was 387 HRK (54 €), and ranged from 252 HRK (35 €) to 445 HRK (61 €).

Significant perioperative blood loss at total arthroplasty hip and knee, necessitating often high allogenic blood transfusions rates with 63.3% of THR and 82.6%

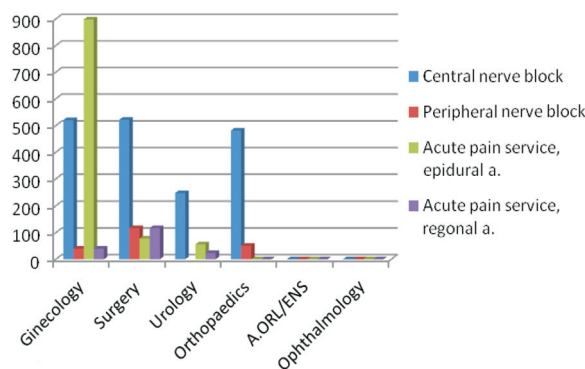


Figure 3. Overview of number and types of surgical procedures performed at different surgical departments in 2012.

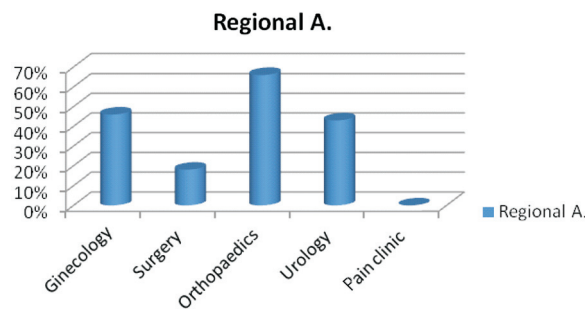


Figure 4. Percentage of overall utilization of RA by hospital departments during 2012.

TABLE 3

Group statistics. Data obtained from information on duration of anaesthesia, duration of surgery, blood transfusion during TKR/THR, cost of material and medication, cost of physician and total costs.

Anaesthesia technique		N	Arythmetic mean	Standard deviation	Standard Error Mean
Duration of anaesthesia	1,00*	101	106,7327	44,85976	4,46371
	2,00**	64	106,6875	52,73951	6,59244
Blood transfusion during total knee/hip replacement	1,00	119	62,9269	134,48218	12,32796
	2,00	68	81,8284	196,45059	23,82313
Total cost	1,00	101	217,1860	186,19749	18,52734
	2,00	64	448,5826	252,35334	31,54417
Duration of surgery	1,00	105	74,2476	37,07549	3,61820
	2,00	64	77,0313	46,65577	5,83197
Material and medication cost	1,00	114	91,1616	57,08991	5,34696
	2,00	68	310,7154	122,14902	14,81274
Physician cost	1,00	105	59,8065	29,86431	2,91446
	2,00	64	62,0487	37,58122	4,69765

*Regional anesthesia **General anaesthesia

of TKR patients (17-19). Risks and cost of allogenic blood transfusion and elective types of surgery several alternative methods have to reduce allogenic blood use. Important steps to reduce allogenic blood use include implementation of restrictive transfusion protocols with a defined hemoglobin value as a transfusion trigger, correction of preoperative anemia with i.v. iron +/- erythropoietin, use of one or more modalities of autologous transfusion (postoperative autotransfusion, preoperative blood donation, pharmacological agents like tranexamic acid (anti-fibrinolytic) regional anesthesia and other complementary procedures. There is sufficient evidence in literature about the cost-benefit of certain methods which makes routine use of allogenic blood in THR and TKR surgery unacceptable even at general orthopaedic surgery departments (20).

Health care institutions cannot ignore the fact of continuously increasing costs, from which it follows that costs of blood transfusion are an important issue of cost rationalisation. Medical records show the perioperative blood loss was not systematically recorded, meaning blood transfusion was given upon subjective assessment of the physician. Since allogenic blood may cause numerous adverse effects, autologous blood may be good substitute as it is an ideal match for the patient. Allowing quicker recovery for the patient, it leads to reduced costs of hospitalization and better cost rationalisation. Possible infections during allogenic transfusion cause additional treatment costs, but also loss of credibility for the hospital concerned.

Our study 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. 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.

Our results show that 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 ($p < 0,01$).

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.

DISCUSSION

Regional anaesthesia is an invasive practical procedure which involves placing needle tips in close to the nerve while injecting a local anaesthetic and other adjuvant

drugs around the nerves. As any medical procedure, regional anaesthesia is not exempt from potential complications and nerve damage can never be completely avoided. However, by developing a comprehensive, consistent and practical approach to the teaching and practice of regional anaesthesia, every anaesthetic department nowadays makes sure that all its members are adopting best practices and using appropriate levels of care when performing regional anaesthesia, in order to minimize the possibility of sentinel events.

There is a pretty confused data base concerning the risks of regional anaesthesia because some studies do not distinguish between temporary and permanent harm. Serious permanent nerve damage associated with regional anaesthesia is very rare; theme an incidence of permanent damage is approximately 1:10,000. A systematic review in 2007 calculated the incidence of both temporary and permanent injury for epidural, spinal and peripheral blocks with differences noted between peripheral, spinal and epidural techniques (21).

In clinical practice relief from pain is a worthwhile humanitarian and medical goal.

Recent literature reports good evidence that regional anaesthesia and analgesia offer a superior quality of analgesia compared to opioid-based analgesia and general anaesthesia (22–27). For this reason alone it may be argued that a regional technique should be offered whenever clinically justified, although others may dispute this. Unfortunately, it is more difficult to find good data to support the hypothesis that regional anaesthesia can influence a reduction in surgical morbidity and mortality, length of hospital stay, and other markers of improved outcome from surgery.

In recent years, there has been a marked growth in the use of both neuraxial and peripheral nerve regional anaesthesia techniques and concerns have been raised about the potentially serious adverse events associated with this increased use. We need to follow up and to examine the currently available evidence for both the risks and benefits associated with major regional techniques to strike a balance, which can inform our clinical practice. Also, where such evidence is lacking, we can then identify the direction that future research might take. Best practice is a complex concept and is subject to significant influence by surgical as well as anaesthetic factors. Ward routines and physiotherapy regimens, as well as local medical custom and practice all influence Best Practice; it is not simply "the Gold Standard" anaesthesia or analgesia technique. As surgical techniques evolve and set new standards of recovery, rehabilitation and mobilization in ERAS programmes, our analgesic techniques also need to adapt and evolve to keep pace with high eststandards (28).

Conclusion. This paper is to illustrate the importance of interdisciplinary approach for achieving optimal quality of medical service and patient satisfaction. The analysis of the reports indicates how the use of a particular anaesthesia technique can contribute to the rationalization and identify key segments of a business process

where there is room for improvement. Given the potential for rare but serious adverse events associated with regional anaesthesia, we need good data to define best practice, to demonstrate individual competence and have safe and effective systems in place to maximise benefits and minimise risks.

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