Оригінальна стаття / *Original article*

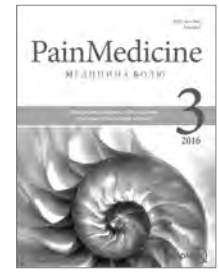
#3 • (3) • 2016

PainMedicine Journal

Медицина Болю // Медицина Боли

www. painmedicine.com.ua

Міждисциплінарний • Науково-практичний журнал



Potential Cost Savings of Off-Site Regional Anesthesia for Minor Orthopedic Surgical Procedures

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Abstract. *This study is limited by the fact that each hospital has different costs for staffing as well as ambiguous billing patterns that make it difficult to correctly appreciate the value of perioperative staffing and costs for the hospital, insurance company, and the patient. Additional costs, as noted above, that were not included in this study would be also added to the potential cost savings. Therefore, our results may in fact appreciate the true difference in costs between the operating room and treatment room anesthesia. As anesthesia providers, we are involved in the perioperative care of surgical patients. We must continuously improve our perioperative care to enhance patient safety while increasing efficiency and decreasing costs. Using regional anesthesia to minimize main operating room times may be an acceptable approach to achieving cost saving measures, as well as reducing unnecessary staffing and main operating resources.*

Key words: *regional anesthesia, minor orthopedic surgical procedures, potential cost*

Introduction

Cost management is becoming an increasingly important aspect of the healthcare industry. With the current trends in health care reform, there is an increasing demand for maximizing patient satisfaction, improving outcomes, all while decreasing the cost of health care delivery. Each year, there are more than 15 million hospital stays in the United States requiring operating room (OR) procedures. Inpatients that undergo surgery often experience a prolonged hospital length of stay that is 2.5 times that of inpatients not requiring surgery [9]. An analysis of the Healthcare Cost and Utilization Project in 2007 revealed that despite accounting only for 26% of hospitalizations, OR-related hospital stays were responsible for more than 46% of hospital costs, roughly $161 billion [10]. Additionally, despite being less ill and being admitted electively to the hospital, the OR patient had double the total hospital stay cost than the non-OR patient. Clearly, managing perioperative costs are an important aspect of reducing health care spending.

In the surgical patient, cost reductions through improved efficiency can be made in a variety of domains, including pre-op, intra-op, and post-operative patient care. In a hospital setting, each patient is placed under the direct care of peri-operative hospital staff, which incurs a set cost per unit time. Such areas include the preoperative holding area, OR, post anesthesia care unit (PACU), otherwise called the recovery room, and admitting/discharge areas. By decreasing the time spent per patient in each of these areas, more patients can be cared for while utilizing the same number of staff hours and resources with a resulting decrease in cost per patient. Similarly, performing surgeries in an outpatient or ambulatory setting can result in significant cost savings versus the main OR.

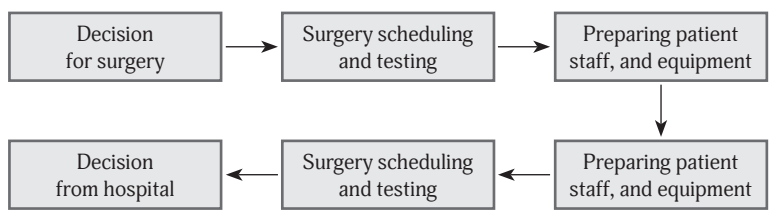

Figure 1. Perioperative flow of events. (Adapted from Enhancing Surgical Care in BC)

At our institution, as with many hospitals, operating room time is a scarce commodity that incurs significant costs for the hospital, but also can be a substantial source of revenue. A myriad of costs are associated with maintaining an operating room, such as supplies, staffing, equipment, and administrative expenses. Many of these costs may be mitigated when procedures are performed in a clinic or ambulatory setting outside of the main operating room [5]. Another study suggested increased efficiency with operative times is strongly associated with decreased hospital costs [4]. When comparing local or regional anesthesia with general anesthesia for knee arthroscopy, a study found decreased operative time, PACU recovery time, and hospital costs [2]. It should be mentioned that reduced PACU recovery time alone is not associated with decreased costs, as costs can be incurred with nursing tasks and interventions, such as medication administration, not just time spent in the recovery room [1]. By allowing procedures to be completed off-site, this typically will increase operating room availability for other procedures that may generate larger revenues, and can decrease staffing needs, and improve overall efficiency.

Despite the obvious cost-savings of off-site surgery, not all patients and procedures are suitable candidates for being completed outside of the main operating room. Some factors involved in determining the optimum location for a surgical procedure include patient comorbidities, procedure length and complexity, and anesthetic management considerations as well.

At LAC+USC Medical center, small orthopedic procedures were routinely performed in a treatment room setting, as they were low complexity procedures requiring minimal analgesia or sedation. Furthermore, often these patients were admitted directly via the emergency department, and they would be considered non-elective cases. Given that most of the operating rooms are utilized for scheduled cases, these types of add-on cases would be disruptive to scheduling efficiency, resulting in case delays/cancellations, the operating rooms running beyond normal work hours, and incurring significant overtime costs. Clearly, these issues pose significant potential for not only increased costs, but patient dissatisfaction as well.

Traditionally, if no operating rooms were immediately available, these procedures would be performed utilizing a sedation nurse and surgeon in the treatment room setting. Patients would often receive IV sedation and opioid-based analgesia combined with local anesthetic infiltration, often with limited success and patient discomfort. Those patients whom were unable to tolerate the procedure would be admitted and wait until a slot was available in the main operating room.

Beginning in 2012, our anesthesiology department, at the request of the orthopedic surgery department, began to perform regional peripheral nerve blocks at the request of the orthopedic surgery department to facilitate patient comfort and safety during these procedures. Nerve blocks included the following: axillary, infraclavicular, supraclavicular, femoral, and popliteal nerve blocks. These blocks are performed by the regional anesthesia fellow, supervised by an attending anesthesiologist, without any sedation. The anesthesiologist would remain to observe for any immediate complications, but was not required to stay for the length of the surgical procedure. The sedation nurse as needed could administer all adjunctive sedation/analgesia, while monitoring the patient. The anesthesiology team was always immediately available to assist with any problems that might have arisen.

Our goal of this study is to evaluate the potential cost savings of off-site orthopedic surgery when utilizing regional anesthesia as the primary method of anesthesia and analgesia. Given the lack of cost-per-minute information for an operating room at our institution, as well as the wide range of costs from one hospital to another, a precise dollar value can be difficult to determine. We chose to focus on the most directly measurable variable: staffing costs. We analyzed reduced staffing needs while performing these procedures off-site from the main OR, and attempted to extrapolate these values using widely available average salary data.

We also wanted to evaluate the success rates of these regional procedures, with a block deemed successful if the procedure was completed without the additional need for any IV sedation or analgesia. Any such sedation would increase the rate of unwanted side effects such as nausea or emesis, sedation, respiratory depression, and potentially cardiovascular depression. There are two main differences in staffing the operating room versus the offsite treatment room. First, we believed that the anesthesiologist would not need to be present for the entire surgery in the off-site treatment room. Second, given the use of regional instead of general anesthesia and the quicker turnaround time between cases, more cases could be performed per unit time in the treatment room than the main OR. Given these circumstances, we hypothesized that minor orthopedic cases using regional anesthesia in the off-site treatment room is associated with decreased staffing costs per case when compared to similar orthopedic cases in the main operating room, without sacrificing patient safety.

Methods

The University of Southern California Health Sciences Institutional Review Board approved this retrospective study. Patient confidentiality was protected by de-identification of the patient data collection sheets. Procedure records and nursing sedation flow sheets were obtained for all patients who received a regional nerve block at the off-site orthopedic treatment room. Records were reviewed to obtain procedure types, operative times, anesthesia procedure times, nerve block(s) performed, medications administered with dosages, and recovery time. Data analysis evaluated mean and median anesthesia, surgical and recovery times, number of patients requiring additional opioids, and sedation required.

As previously mentioned, calculating and comparing direct costs for procedures in the operating room and off-site surgical treatment room is a difficult task as there is no definitive standard to compare the two. We attempted to standardize the two settings by comparing staffing costs based

Table 1. Staff cost per position based on data collected from www.salary.com (OR = operating room; TR = treatment room)

Staff	Annual salary	Per minute	Cost per day	OR cost/case	TR cost/case
OR nurse	$68861	0.551	264.48	44.08	33.06
Surgical tech	$40799	0.326	156.48	26.08	20.07
Anesthesiologist	$345787	2.01	964.8	160.8	32.5
PACU nurse	$74460	0.6	288	27	7.63
Resident	$55000	0.29	139.2	23.2	17.4
Ortho surgeon	$428361	2.49	1195.2	199.2	149.4
Environmental Services	$35000	0.28	134.4	8.4	2.8

on hourly rate. Staff cost reductions were calculated using nationwide average salaries that were publicly available (www.salary.com). Using this information, the staff costs were calculated using the average procedure times, an assumed 20 or 30-minute case turnover time for the off-site and main OR, respectively, and a standard 8-hour operating time window. Since the anesthesiologist did not remain to monitor the patient for the duration of the off-site procedures, their costs were determined based upon a presumed 10-minute preoperative evaluation plus the average recorded nerve block time to completion. Nerve blocks were deemed successful if no further sedation or analgesia was given during the procedure.

Results

For all cases we allow for a 10-minute anesthesiologist preop assessment. We calculated the cost for each employee per day, then divided by the number of cases we could complete with both settings in order to calculate the cost per case based solely on personnel costs. Recovery nurse, surgical tech, and environmental services are calculated per minute of usage, since they can work in multiple rooms. Residents and surgeons, surgical techs, OR nurses are calculated per case, since they can only do one case at a time. Treatment room anesthesiologist is calculated on cost per minute usage, since they did not remain in the room, but the Main OR anesthesiologist must remain assigned to only that OR each day, so the salary is divided by the number of cases that can be performed. The average main OR case stayed in the PACU for 45 minutes while the average treatment room case was in recovery for 12.72 minutes.

Cost savings can be calculated in a number of different ways, all of which are guided by different variables and assumptions. Staff salaries, material costs, and operating room scheduling efficiency will all vary significantly from one institution to another, and such data is difficult to obtain due to the confidential nature of hospital specific cost structures. Despite these challenges, we attempted to estimate savings by utilizing publicly available data when published. At LAC-USC Medical center, one source of cost reduction is the decrease in staff required to perform a case in the outpatient treatment room, versus the main operating room. All cases scheduled for the main operating room would require an OR nurse, surgical technician, anesthesiologist, surgeon, and post-anesthesia care unit recovery nurse. Cases completed in our treatment room would also require an OR nurse, surgical technician, and surgeon, however, we assumed that the anesthesiologist was only needed for the nerve block. **Furthermore, recovery time is minimal and PACU admission is not necessarily required, as patients do not receive sedative medications, and the surgical procedures performed are minor.** Utilizing publicly available average salary data, we estimated the costs associated with these reduced staffing needs.

Overall, orthopedic surgeons have the highest cost, while the anesthesiologist is responsible for the second highest cost per day, while environmental services, residents, and surgical technicians have the lower costs per day (Table 1). There is a large difference in cost per case between OR and TR cases, as seen in Figure 2. The largest cost differential is amongst the anesthesiologist and orthopedic surgeon, largely due to the faster turn-around time.

The majority of blocks performed are axillary nerve blocks as they are routinely used for most upper extremity orthopedic procedures for surgical anesthesia of the hand. Less commonly, the infraclavicular and supraclavicular nerve blocks were used in the treatment room (Figure 3). Popliteal

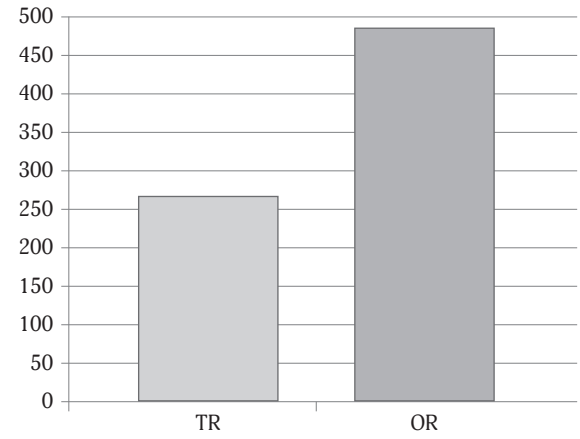

Figure 2. Staffing costs ($) per case for treatment room (TR) and operating room (OR)

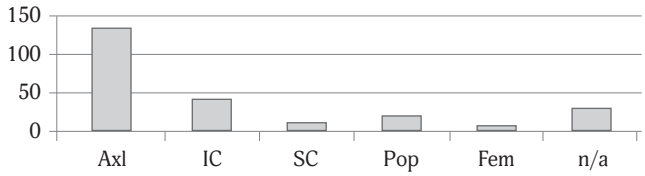

Figure 3. Number and location of nerve blocks performed
Axl – axillary; IC – infraclavicular; SC – supraclavicular; Pop – popliteal; Fem – femoral; n/a – not listed

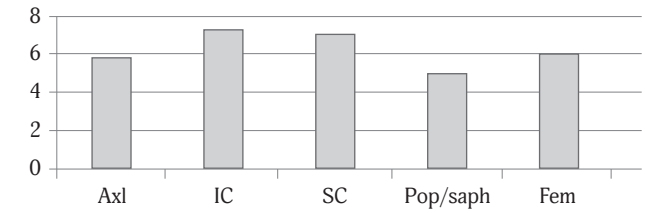

Figure 4. Average time in minutes, necessary for performing the indicated nerve block
Axl – axillary; IC – infraclavicular; SC – supraclavicular; Pop – popliteal; Fem – femoral

and femoral nerve blocks are used for lower extremity orthopedic procedures and were rarely used in the treatment room, likely as the lower extremity procedures are larger and more complicated, requiring the main OR.

As seen in Figure 4, average time spent for each type of nerve block was approximately 6 minutes, with minimal variability between the types of blocks. Each type of nerve block possesses its own technical challenges and different techniques are plausible. Despite this, the anesthesia time was minimal compared to the operating time, 6 minutes versus 45 minutes. This decreased anesthesia time enhances perioperative efficiency and decreases ancillary costs associated with running an operating room, aside from physician and nursing time.

If one were to compare operative times based on anatomical site (Figure 5), it would be apparent in our data pool that orthopedic surgery involving the lower extremity (femur, fibula, tibia, and patella) was the most time consuming while the ankle (tarsal) surgery was the least time consuming. The reason behind this is that the lower extremity types of surgery are often longer, more complicated, and frequently requires larger incisions and extensive plating and screwing. The other anatomical sites (phalanx, MCP, tarsal, carpal, and UE) were all about 40 minutes in surgical length. Only 4 patients required a small supplemental opioid dose (< 2%) which did not delay discharge.

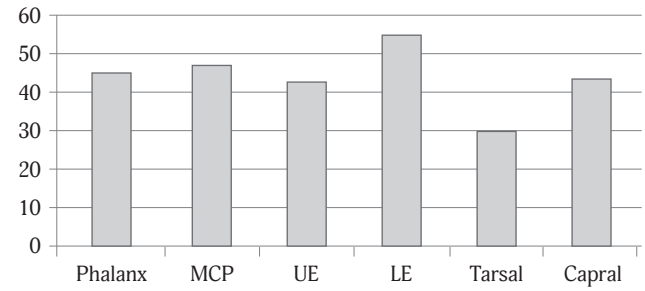

Figure 5. Average surgical time in minutes per anatomical site
MCP – metacarpal; UE – upper extremity; LE – lower extremity

The typical operating room will run scheduled cases from 7:30 am until 3:30 pm, after which, additional staffing considerations would be required. Using our average recorded procedure time (45.55 +/- 31.09 minutes), and presuming a 20-minute turnover time for a small off-site procedure room, this would allow for 8 cases to be completed, as a total staffing cost of $2102.88 per day, or $262.86 per case. Cases performed in the main operating room, using the same average procedure time and an ideal 30 minute turnover, would allow 6 cases to be completed for a total staffing cost of $2932.56, or $488.76 per case. This also factors in the reduced recovery time for the treatment room patients of 12.7 minutes versus a common main operating room postoperative recovery time of 45 minutes.

Discussion

With increasing demands to decrease hospital costs and increase efficiency, anesthesiology providers are finding new ways to decrease anesthesia and recovery time, while increasing intra-operative efficiency [6, 7, 8]. With the current economic and political pressure to reduce health care costs, health administrators are searching to find ways to cut costs, without marginalizing patient care. The old adage of choosing cheaper health care or better health care is now widely being refuted. One researcher analyzed a perioperative home model that decreased cost and readmission while enhancing patient care (Di Capua). Providing regional anesthesia in place of general anesthesia may be of significant value, not only in increasing efficiency and reducing costs, but also delivering safer anesthesia for patients with comorbidities. Furthermore, large academic medical centers are often unique in having anesthesiologists perform multiple duties outside of the operating room, such as pain management, perioperative care for patients in the pre-op, post-op, and ICU setting as well as teaching responsibilities. As a side note, allowing for regional anesthesia fellows to perform these regional procedures will allow for a significant amount of time for performing more procedures and investing time in research and other areas of active learning.

A portion of the cost savings from these off-site procedures was based on the idea that the anesthesiologist would be free to perform other revenue generating activities while they are not performing regional anesthetic procedures for this specific subset of patients. Such activities can include Post Op Recovery supervision, research, teaching, or regional nerve blocks for other operative cases, as long as a member of the regional team remains immediately available to the treatment room staff.

A more simplified approach would calculate the cost reduction in terms of reduced utilization of the main operating room. By performing surgeries in the clinic setting, you will allow for the operating rooms to be utilized for other cases, often cases associated with higher revenues. Utilizing a reported average $42 cost-per-minute of an operating room, including anesthesia and facility fees, would result in a substantial estimated savings. Table 2 illustrates the potential for increased operative costs secondary to resident surgeons and associated increased operative times.

Table 2. Additional cost of resident surgeon participation in operative costs for ENT surgery [3]

Procedure	Average Increase in Length Due to RS Participation, min	Average Additional Cost per RS Case, $[1]	No, of Department Procedures in a 12-Month Period[2] With Resident Participation	Average Additional Cost of RS for I Year, $
CPM	6.8	285.60	28	7996.80
Septoplasty	38.3	1608.60	166	267,027.60
Parotidectomy	27.4	1150.80	5I	58.690.80
Thyroidectomy	–0.4	(–16.80)	47	(–789.60)
Mastoidectomy	51.0	2142.00	44	94,248.00
Tonsillectomy	11.3	470.40	51	23,990.40
Total			387	451,164.00

Abbreviations: CPM – ericopharyfigeal myotomy; RS – resident surgeon.

[1]Average cost of operating room time calculated ax $42 per minute.

[2]2011–2012 Academic year.

We disregarded the cost of performing the regional nerve block itself, as it is a relatively small materials cost, and regional blocks would likely be performed for these patients regardless of whether the surgeries were performed in treatment or operating room. Additional cost savings would be expected with off-site surgery due to the substantial fixed costs of each operating room. These calculated costs are simply the staffing costs and does not include the significantly higher cost of the equipment in the OR, depreciation of the OR equipment with each use, as well as lost income from being unable to utilize the OR for other cases. Small off-site treatment rooms are well known to cost significantly less.

This study is limited by the fact that each hospital has different costs for staffing as well as ambiguous billing patterns that make it difficult to correctly appreciate the value of perioperative staffing and costs for the hospital, insurance company, and the patient. Additional costs as noted above that were not included in this study would also add to the potential cost savings. Therefore, our results may in fact under appreciate the true difference in costs between the operating room and treatment room.

As anesthesia providers, we are involved in the perioperative care of surgical patients. We must continuously improve our perioperative care to enhance patient safety while increasing efficiency and decreasing costs. Using regional anesthesia to minimize main operating room times may be an acceptable approach to achieving cost saving measures, as well as reduce unnecessary staffing and main operating resources. Further studies would be necessary to further validate this theory as well as analyze other potential methods at decreasing operative times, while ensuring patient safety [11, 12].

As a closing note we must report that while we had very high patient satisfaction, no complications from the regional anesthetics performed, and no significant surgical complications; we were required to discontinue this treatment room strategy because of administration concerns. Our orthopedic department had not developed a formal policy specifying which surgical procedures were suitable for the treatment room environment, and the American Society of Anesthesiology (ASA) standards require that an anesthesia provider remain with the patient throughout any surgical procedure if surgical anesthesia is provided, even if that anesthesia is a peripheral nerve block without any additional sedation or other analgesia.

Our data certainly indicates that an anesthesia provider is not necessary to monitor a patient once a peripheral nerve block has been established for minor orthopedic procedures, as long as no sedation has been given and a registered nurse trained in sedation remains to monitor the patient. Of course an anesthesia provider should be available to assist if any further anesthesia issues should arise. In this regard a regional anesthesia fellow and attending were always available. The requirement for an anesthesia provider to remain with the patient in such off site procedures would significantly decrease the cost savings without improving safety.

As a side note, although the data is note presented here, we also at the same time provided a similar service for closed reductions of extremity fractures in the Emergency Department with excellent patient satisfaction, and significant reduction in opioid use. Again, the anesthesia providers did not remain in the emergency room area after it was determined that the nerve block was successful.

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Потенциальная экономия средств от регионарной анестезии вне операционной при незначительных ортопедических хирургических процедурах

Jack Berger, David F. Gutierrez, Amir Shbeeb, Lynn Ngai, Zara Meliksetyan, Vladimir Zelman

Резюме. *Исследование ограничивается тем фактом, что каждая больница имеет различные затраты на персонал, а также неоднозначные расценки, которые не дают возможности правильно оценить значение периоперационного кадрового обеспечения и расходов больницы, страховой компании и пациента. Дополнительные расходы, как было отмечено выше, которые не были включены в данное исследование, можно также добавить к потенциальной экономии средств. Таким образом, наши результаты могут на самом деле оценить истинную разницу в цене между анестезией в операционной и процедурной. Мы участвуем в интраоперационной помощи хирургическим больным. Мы должны постоянно улучшать нашу интраоперационную помощь в целях повышения безопасности пациентов при одновременном повышении эффективности и снижении затрат. Использование регионарной анестезии позволяет свести к минимуму время нахождения в операционной комнате и может быть приемлемым подходом по снижению затрат, а также сократить ненужные кадровые и основные производственные ресурсы.*

Ключевые слова: *регионарная анестезия, незначительные ортопедические хирургические процедуры, потенциальные расходы.*

Потенційна економія коштів від регіонарної анестезії за межами операційної при незначних ортопедичних хірургічних процедурах

Jack Berger, David F. Gutierrez, Amir Shbeeb, Lynn Ngai, Zara Meliksetyan, Vladimir Zelman

Резюме. *Дослідження обмежується тим фактом, що кожна лікарня має різні витрати на персонал, а також неоднозначні розцінки, які не дають можливості правильно оцінити значення періопераційного кадрового забезпечення та витрат лікарні, страхової компанії і пацієнта. Додаткові витрати, як було зазначено вище, які не були включені в дане дослідження, можна також додати до потенційної економії коштів. Таким чином, наші результати можуть насправді оцінити справжню різницю в ціні між анестезією в операційній і процедурній. Ми беремо участь в інтраопераційній допомозі хірургічним хворим. Ми повинні постійно покращувати нашу інтраопераційну допомогу з метою підвищення безпеки пацієнтів при одночасному підвищенні ефективності та зниженні витрат. Використання регіонарної анестезії дозволяє звести до мінімуму час перебування в операційній кімнаті і може бути прийнятним підходом щодо зниження витрат, а також скоротити непотрібні кадрові та основні виробничі ресурси.*

Ключові слова: *регіонарна анестезія, незначні ортопедичні хірургічні процедури, потенційні витрати*