



Economic Impact, Cost, and Reimbursement Issues

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Clinical Vignette

A 65-year-old male with a history of insulin-requiring diabetes mellitus and gastroesophageal reflux disease (GERD) presents for left total knee arthroplasty. The patient states that he had the same surgery on the right side 7 years prior, for which he received general anesthesia with an epidural for postoperative analgesia. The surgery time was 2.5 h, due to delayed emergence from general anesthesia. His postoperative hospital course lasted 3 days, which was complicated by postoperative nausea and vomiting (PONV). Upon discharge, the patient was discharged on oral oxycodone.

On this admission, you discuss the new protocol for Enhanced Recovery After Surgery (ERAS) that your hospital surgery center has instituted. Given the painful nature of total knee replacement surgery, you explain to the patient that the new protocol has been designed with a multimodal analgesic approach that will also help maximize early ambulation through physical therapy sessions and allow for discharge within 1–2 days. After reviewing the patient's medical

history, you explain the anesthetic will consist of a spinal anesthetic with an adductor canal block.

Utilizing spinal anesthesia will help minimize the PONV the patient experienced last time, and an adductor canal block will help with pain control as well as spare motor function in the left leg postoperatively. The patient states that he had a relative who had surgery and asked about “going home with device that provides pain control.” You explain that there is a possibility to insert a catheter adjacent to the nerve sheath. This approach will provide continuous local anesthesia and analgesia for up to 72 h via an ON-Q pump that a patient can remove at home; however this service has not yet been set up at your surgical center.

You proceed to explain the anesthetic to the patient and the details of the nerve block which will be performed by the acute pain team (dedicated nerve block anesthesiologist and an assistant). This block will be done in a dedicated block room that has an ultrasound and all the requisite supplies, in close proximity to the operating room.

Prior to going to surgery, the patient takes celecoxib and pregabalin, which is part of the multimodal analgesic regimen in the protocol. The patient proceeds to surgery. The surgery takes 1 h and 35 min to complete and does not have the increased time from the delayed emergence that occurred with the prior operation. The patient is able to bypass Phase I of PACU due to minimal sedation utilized during the surgery and the absence of nausea and vomiting. Postoperative

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day one the patient is discharged to rehab after beginning his physical therapy and functioning with less pain than with his prior surgery.

Increasing Cost of Healthcare Economics

Healthcare costs have increased, with 17.8% of the gross domestic product (GDP) spent on healthcare costs and projected to be 19.3% by 2019, leading to heightened scrutiny, in an effort to balance safe and efficient care [1–3]. Therefore, interest in the economic assessment of healthcare processes and treatments with a precise understanding of which direct and indirect costs influence these processes will be important in the evaluation of healthcare economics.

As a result of this focused emphasis on cost containment, a shift has occurred in operative care of patients from what were once surgeries requiring inpatient admissions to now outpatient surgeries. This demand for increased efficiency and shorter hospital stays has magnified the role of anesthesiologists and their management of postoperative analgesia [4].

With a rapidly aging population and a higher level of morbidity exists, certain perioperative patients will require anesthetics that reduce the potential deleterious impact of agents on their cardiac and respiratory function. In addition, the increase in the number of obese patients has also posed challenges in the perioperative management of these patients. Without careful concern about the unique concerns of patients with comorbidities, healthcare costs may be increased in the postoperative phase of care. Diligent stratification and formalized protocols, however, serve to decrease the overall costs of readmission rates for pain, infection, or exacerbation of their comorbidities.

To that effect, the Enhanced Recovery After Surgery (ERAS) protocols have attracted importance as a way of providing value while decreasing complications, leading to a safer and cost-effective manner for patients undergoing surgery [5, 6]. ERAS has been utilized for patients undergoing colorectal, gynecologic sur-

gery, and other surgical indications. As part of a collaborative care improvement model, ERAS programs have the potential to promote cost savings by leading shorter hospital stays as compared to non-pathway care. Investigation of patient factors leading to prolonged hospital stay after surgery has been evaluated [7]. In fact, the Triple Aim Framework from the Institute of Healthcare Improvement (IHI) highlights (a) improving population health, (b) improving patient experience, and (c) lowering per capita costs, as a goal that healthcare providers should embrace for the future of healthcare [8]. The prototype partners participating in the Triple Aim in the United States is available online and along with the associated measures/information [9].

These multidisciplinary protocols highlight anesthesiologists as key leaders in the perioperative arena. Anesthesiologists are uniquely poised to provide care preoperatively, intraoperatively, and when applicable postoperatively along the spectrum of a patient's surgical experience.

The Role of Anesthesiologist in Combating Costs

The cost for surgical care accounts for approximately 52% of hospital expenses in the United States [10]. Historically, surgeons served as the perioperative leader of the care team; however with increasing demands for intraoperative productivity, this role has shifted [11]. While hospitalists will help co-manage patients from a medical perspective, anesthesiologists have emerged as the preferred perioperative consultants because of their understanding of preoperative comorbidities, intraoperative management strategies, and postoperative pain management skills. The anesthesiologist therefore has a key role in standardization of care and demonstrating value with intervention choices in accordance with available financial capital. In evaluating healthcare economics, anesthesiologists play a central role in opportunity costs with the efficient use of limited resources in the future [12].

The anesthesiologist leads in evaluating cost minimization, cost-effectiveness, cost utility, and

cost benefit for technologies. Core processes in cost analysis must be considered by key decision-makers [12]. *Cost minimization* involves evaluating two alternative approaches in a process to reach an endpoint. This model strictly evaluates cost differential. *Cost-effectiveness* involves evaluating two alternatives, assessing their endpoints, and comparing the costs of achieving the differing endpoints. *Cost utility* allows for multiple outcomes (risks and benefits) combined into one measure. *Cost-benefit* evaluation analysis takes outcomes and translates them into financial outcomes, represented as dollar equivalents. As health entities design protocols for patient care, this will be met via the ERAS programs and also through the postsurgical home (PSH), distinct entities. Regardless of the platform, however, cost containment coupled with safe care is the common goal of protocol-driven patient management programs.

In evaluating the costs related to the anesthetic care of the patient, many factors are involved including the practice region, patient population, type of surgical procedure, and ability to have home-based acute care, along with fixed and variable costs [13]. The decision to offer a service should undergo a rigorous evaluation based on the resource availability, the resource cost, and the benefit potential and actually realized. Anesthesiologists play a key role in process evaluation for patient flow in the perioperative arena.

Despite the benefits from a patient satisfaction perspective and lower potential financial cost to regional anesthesia, there is perception among surgeons that the delivery of preoperative regional anesthesia slows down surgery times, leading to delays in the perioperative process [14]. In an evaluation done by Stahl et al., an "Operating Room of the Future" (ORF) was designed as a way to streamline and facilitate smooth transition between the preoperative, intraoperative, and postoperative phases [15]. They found that perioperative improvements other than trying to facilitate a faster operating time, actually, were the activities that led to greater cost containment. These adaptations are referring to activities that can be done in parallel

with another simultaneous surgery (i.e., placing a peripheral nerve block in a patient in the preop area prior to surgery). On the other hand, Eappen et al. showed that despite surgeon perception, the anesthesia-controlled time (refer to paragraph below) was not improved with a separate regional anesthesia team, especially in the setting of longer operations with prolonged turnover times [16]. This study suggested exploring other areas as a source of potential delay as opposed to the preoperative block placement.

During the anesthesiologist's role of the patient in the perioperative setting, certain time concepts are important to consider, namely, anesthesia-controlled time (ACT) and turnover time. ACT refers to the time of operating room entry until the sterile prep and positioning of the patient. The time is then paused while the surgical intervention takes place. ACT then continues from the end of surgery until patient exit from the operating room. Turnover time (TOT) reflects the time from the patient leaving the operating room to the subsequent patient is brought into the operating room for the next procedure. Providing a regional anesthetic consecutively results in lower ACT time, lowest sum of ACT plus TOT times, and reduced unplanned hospital admissions most often related to pain and PONV [17].

Cost reduction and anesthetic choices are crucial factors demonstrating the strengths of regional anesthesia as a primary type of anesthetic when suitable. The choice of local anesthesia was evaluated for cost-benefit purposes. An observational case-control cost-minimization study was used to compare chloroprocaine with mepivacaine for outpatient popliteal block for foot surgery [18]. One hundred patients were given either 30 mL of 3% chloroprocaine or 30 mL 1.5% mepivacaine. The authors noted that onset time to block and duration of block (sensory and motor) was shorter with the use of chloroprocaine. These differences translated into a discharge time of 120 min earlier for the chloroprocaine group. Patient satisfaction and block efficacy were not impacted by the shorter-acting agent. Integrating this data into regional anesthesia protocols will be helpful to improve overall efficiency and economics.

Regional Anesthesia as a Way of Improving Economics

The infusion of regional anesthesia (RA) practice serves as a bona fide approach to combatting the rising costs of healthcare delivery in the perioperative milieu. Postoperative pain management has received considerable scrutiny from accreditation entities and pain management societies not only because of its' impact on patient satisfaction but also postoperative care [19]. Regional anesthesia can lead to fast-tracking of patients by optimizing postoperative analgesia by an opioid-sparing effect [20]. RA, compared to systemic analgesia, presents global improvements via cost savings as well as a reduction in opioid use and comorbidities [21]. These benefits are echoed in the orthopedic literature for anterior cruciate ligament surgery and total knee arthroplasty (TKA), allowing for decreased postoperative pain, morphine consumption, and adverse effects [22, 23].

Regional techniques have been advocated as a preferred approach due to the ability to decrease certain postoperative complications including, but not limited to, respiratory depression secondary to IV opioid use for pain control. A regional anesthesia approach in the perioperative setting has decreased the complications from general anesthesia, leading to improved pain scores, less PONV, earlier discharge, and less risk of hospital readmission. Richman et al. published a meta-analysis which confirmed the superiority of perineural analgesia via continuous catheter over opioid therapy for visual analog scores, nausea/vomiting, and pruritis [24].

In addition, the use of regional anesthesia allows for avoidance of tracheal intubation and positive pressure ventilation which may be less ideal in certain patients, reduces sympathetic activation and subsequent inflammation, and decreases venous stasis and the risk of developing pulmonary embolism. One of the significant sources of increased healthcare costs and decreased patient benefit after any surgical procedure is the persistence of debilitating pain along with the presence of postoperative nausea and vomiting (PONV). When effective analgesia as provided by regional anesthesia techniques

occurs, concomitant antiemetic prophylaxis results in rapid recovery of patients, and PACU bypass, leading to a "fast-tracking" discharge of patients [25]. All of these advantages lead to long-term cost savings by reducing postoperative complications which may lead to longer hospital stays and increased medical expenses.

RA may also have a role in the fiscal health of an anesthesia group practice. A meta-analysis evaluated ten independent trials involving 330 patients undergoing general anesthesia and 348 patients undergoing neuraxial block and highlighted the salubrious nature of the neuraxial technique. From a potential cost savings, neuraxial block led to a quicker operating room time by 7 min and 275 mL/case less blood loss [26]. Williams et al. showed that using regional anesthesia for ambulatory orthopedic surgeries confirmed process improvement, efficiency, and benefit in recovery profiles [27].

While traditionally providing a powerful way of reducing complications and effects of general anesthesia in patients undergoing orthopedic surgery procedures, the use of regional techniques has also provided safe and efficient management of patients undergoing visceral surgical procedures. The transversus abdominis plane (TAP) block serves to anesthetize the lower portion of the abdomen from T10-L1. Blockade is effective for abdominal and inguinal surgery. Catheters have been placed to facilitate prolonged analgesia, allowing for outpatient discharge and recovery [28]. In a randomized triple-blind trial evaluating the efficacy of the TAP block after total laparoscopic hysterectomy, patients with the TAP block had a notable reduction in pain scores compared with a placebo group initially; however the benefit was not present, and no difference was present between treated and placebo patients at 24 and 48 h [29]. In a meta-analysis, however, TAP blocks were shown to provide improved postoperative pain, with an improvement in outcomes and a decrease in postoperative opioid consumption when administered in the setting of laparoscopic surgery [30]. TAP block has been used in the placement of peritoneal dialysis catheters under monitored anesthesia care in a case series [31]. Despite significant coexisting

medical conditions including renal dysfunction and cardiac and coagulation disorders, these seven patients in this study were managed with the TAP block along with supplemental analgesics. In this population, the use of RA to potentially bypass Phase I recovery and to avoid the prior mentioned concerns of GA serves as a boon to patients and providers [31].

The popularization of perioperative care pathways to achieve early recovery after surgical procedures has been shown to improve outcomes. The development of ERAS and PROSPECT (evidence-based, procedure-specific postoperative pain management) has been designed initially for colorectal surgery patients but has since been expanded to many surgical specialties. Sammour and colleagues published a cost analysis of ERAS in colorectal surgery. Because of the reduction in total hospital stay, intravenous fluid use, complications, and duration of epidural use in the ERAS group, decreases in postoperative resource utilization resulted in greater cost savings over the long run in comparison with the cost of setting up and maintaining an ERAS program [32]. Regional anesthesia is bundled into the menu of options for patients as part of the ERAS enhanced recovery protocols (ERPs) and designed to standardize the anesthetic and analgesic regimen [33]. Data published has illustrated that regional anesthesia directly improved outcomes and the ability to achieve the goals of ERPs.

Regional anesthesia was noted to have a beneficial impact on measures of function and on economic outcomes, with noticeable improvements in patient outcomes [34]. Given these benefits, regional anesthesia has an important role in ERPs and can serve to achieve the goals of the Triple Aim, by improving pain and PONV and decreasing length of stay [33].

Translating the seemingly salubrious benefit of regional anesthesia for surgical patients to financial benefits, that is, presenting a cost-benefit analysis, requires a more complex evaluation of all the factors leading to charges and costs during the perioperative process. An observational nonrandomized study done by Williams et al. combined hospital cost data with surgical outcome data [35]. It was found that the use of nerve blocks for ACL surgery reduced the PACU admission rate to 18% and led to a decrease in the unplanned hospital admission rate to 4%. This bypass led to a mean reduction in hospital cost of \$173 per patient. Furthermore, when the data were analyzed with multifactorial regression analysis, the effect of PACU bypass was to lower hospital costs by 12% (\$420 per patient). On the converse side, patients who required hospital admission after surgery were responsible for an increased hospital cost of 11% (increase of \$385 per patient). The additional effects on this improvement in patient flow would be a reduction of nursing staff in the PACU, which would theoretically lead to less nursing cost.

The advent of technology in regional anesthesia has led to cost benefits. Another analysis, presented as a letter to the editor, reported a cost analysis performed for equipment and supplies for patients undergoing infraclavicular block for upper extremity surgery [36]. Conventional nerve stimulator was evaluated against ultrasound technique for differences in procedure costs and time for procedure. The authors concluded that for infraclavicular catheter placement, ultrasound guidance led to faster blocks and shorter onset time, yielding savings of \$13.90 per case.

A prospective cohort study evaluated 120 consecutive patients to two groups receiving popliteal block with an elastomeric pump with ropivacaine delivery as inpatients or outpatients after foot surgery [37]. The day discharge group had decreased total management costs as compared to the inpatient group. This change was due to a greater likelihood of PACU bypass. This study also followed patients and evaluated a cost analysis up to 6 months in terms of work lost and found benefit with those patients able to be in the day discharge group. The authors opine that

How Regional Anesthesia Fosters Fast-Track Elements/ERPs

- Opioid-sparing effects/nausea and vomiting
- Early oral feeding
- Rapid patient mobility
- Quicker recovery from general anesthesia

the main cost-saving factors which attributed to regional anesthesia include shorter ready-for-surgery time, reduction in length of stay, and recovery room bypass.

Choices by the perioperative physician are also of key importance in patients undergoing outpatient surgery. While patients may typically undergo general anesthesia for outpatient procedures, the use of regional anesthesia may provide a superior recovery as compared to general anesthesia. Hadzic et al. performed a randomized study comparing patients receiving general anesthesia and intra-articular injection of local anesthetic to patients receiving lumbar plexus/sciatic block in terms of operating room time, PACU bypass, and time to actual discharge home [38]. Patients receiving the blockade technique had a greater likelihood of PACU bypass and a shorter time to discharge than those patients undergoing general anesthesia, differences that would translate to a lesser cost of care for patients.

The comparative costs between general and regional anesthesia were compared in patients undergoing arthroscopic shoulder surgery as well, which showed an improvement in monetary costs for the regional group of 8 euros, with lower PACU costs and time [39]. It is no surprise that anesthesia workflow also improved with a regional approach. Time is saved on emergence, leading to less operating costs.

In addition to the cost benefits that regional anesthesia has for patients undergoing outpatient surgery, operations traditionally requiring inpatient admission have been shown to cost less with regional anesthesia. In a study evaluating the feasibility and the cost incurred for ambulatory vs. admitted patients after total knee arthroplasty, the ambulatory status of patients was facilitated with benefit from continuous femoral nerve blocks [40]. The ambulatory patients accrued 14% less charges than those patients who were admitted; the regional anesthetic was a significant factor in the cost savings in these patients.

Comorbid factors are associated with the development of surgical site infections that can be directly modulated by regional techniques [41]. Additionally, a retrospective propensity-

matched cohort study evaluating data from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database for patients undergoing total hip arthroplasty from 2007 to 2011 was used to evaluate the benefits of regional techniques [42]. Logistic regression analysis was used for correlating anesthetic approach and risk of length of stay in hospitals, deep surgical site infections, mortality rates at 30 days, and cardiopulmonary complications. 5103 surgical procedures out of 12,929 were performed with a regional technique. Odds ratio analysis demonstrated that regional group had lower adjusted odds for deep infections, 5% decrease in hospital stay for patients with regional anesthesia, 27% decrease in odds of having a prolonged hospitalization, and a decreased incidence of cardiopulmonary complications.

Setting Up a Regional Service

As is evidenced by the power of the studies presented above, regional anesthesia leads to favorable costs during the healthcare delivery of surgical patients. Aside from cost benefits, enhanced patient satisfaction with analgesic quality impacts favorably on patient care and the overall hospital experience. As medical centers have improved patient satisfaction scores and better health outcomes, direct and indirect economic impact results.

The perioperative physician practicing regional anesthesia needs to take a careful and precise evaluation of the tools and equipment of the trade in order to effectively perform the tasks at hand. Intraoperative anesthesia costs make up approximately 6% of total costs in the perioperative period. Half of these costs are based directly on the choices of the anesthesiologist's clinical decisions [43]. Many factors may influence how the anesthesiologist decides which anesthetic technique would be best suited for their patient. Factors influencing decision-making include patient age, medical/surgical history, prior anesthetic history, scheduled surgery, and current medications including pain medications and/or anticoagulant therapies.

Considerations for Anesthetic Technique

- Age of patient
- Comorbidities (cardio/pulmonary status, anticoagulation status)
- Medications (chronic pain medications, blood-thinning medications)
- Surgical history (repeat/revision on an extremity)
- Any current issues that may influence the practitioner's decision (localized infection, high white blood cell count)
- Anesthetic complications in the past, side effects from anesthesia, family history of anesthetic problems (history of malignant hyperthermia may influence decision to proceed with regional)
- Patient consent/anesthetic concerns
- Inpatient or outpatient surgery, expected duration of hospitalization

The location of the perioperative setting (hospital vs. outpatient) and type of practice (private vs. academic) play an important role in determining whether the patient population will benefit from such a service and whether the services will result in overall cost containment while generating increased revenue.

A review by Swenson et al. highlights the important considerations for the regional physician to entertain when presenting and formulating a regional practice to provide care in a safe, efficient, and cost-conscious manner [44]. For example, the use of ultrasound (US) guidance as opposed to the most historic use of nerve stimulation (NS) is highlighted and presented as allowing for more successful blocks. While new adopters of US therapy may not be as facile as experienced sonographic anesthesiologists, the combined use of US and NS may allow the provider to perform ultrasound for real-time visualization of anatomy and medication deposition but allow for the familiar crutch of NS.

The combination of US and NS has led to needle redirects and slower block performance times than just utilizing US. Additionally, the use

of echogenic needles is not necessarily advocated as a cost-saving tool despite this modification allowing for better needle visualization during encroachment into tissue. The use of specific nerve-stimulating catheters as compared to conventional catheters also does not appear to lead to a cost-savings benefit. Stimulating catheters have been described to lead to longer procedure times, procedural discomfort, increased failure rates, and iatrogenic injury. Newer technology may also add improved image fidelity: Swenson and colleagues found that magnetic-guided ultrasound improves positional needle accuracy when compared to conventional ultrasound in both novice and experienced practitioners [45]. This enhanced imaging could play a role in efficiency and overall quality of nerve blocks.

The infusion pump, typically delivering local anesthetic and/or clonidine after surgery, is the next technological tool that extends the operative analgesia into the perioperative state in the hospital or as an outpatient. The choice of type of infusion pump is an important consideration for anesthesiologists to balance finances with function. Disposable infusion pumps and non-disposable pumps are utilized in clinical practice. These pumps are further classified and have cost differences based on capability of infusions. For example, pumps may provide for fixed basal units to variable capable rate settings and also bolus capable units. It will be important to factor these decisions in deciding what tools will be necessary to create a successful regional program. Overall, the choice of supplies by regional anesthesia providers should emphasize a favorable cost-benefit ratio.

In order to develop a successful regional program, the customers of the anesthesiologist (patients, surgeons, and administrators) must be satisfied with the service and the results. While first and foremost, regional anesthesia must be safe and effective for the patient, perioperative readiness must also be taken into consideration as quickly as possible to enhance the flow of the operating room environment.

In order to balance these seemingly opposing demands, trained personnel proficient in regional anesthesia and the use of US nerve blocks must

lead the perioperative team for this service. The use of a “block room,” where regional anesthesia procedures can be performed prior to the intended surgery, may serve to reduce ACT and allow for expedient patient surgical preparation from an anesthesia perspective [46]. The parallel workforce may inherently operate in a smoother fashion in academic settings where there are residents or in private settings where there are teams of anesthesiologists, nurse anesthetists, and anesthesia assistants working within their respective scope of practice, with the anesthesiologist as the leader of the team [47]. Additionally, the block room enables a controlled environment where equipment and dedicated supplies are readily available.

Preparing premade kits can help with efficiency, along with creating a cart in which all the equipment necessary for procedures are located. The mobility of this unit may allow for an easy transport to the bedside in different service locations. In order to provide a safe environment, resuscitative medication or a crash cart should also be available per medical center/surgery center policy.

Streamlining this perioperative regional anesthesia/analgesic process originates preoperatively when the patient initially decides to have surgery. Surgeons would ideally introduce the concept of a regional anesthesia for postoperative analgesia. This initial communication sets the table for the process from an established provider who the patient has rapport with. Surgeon buy-in to regional anesthesia allows for reducing anxiety about a new procedure discussed with the patient, at times, for the first time, on the day of surgery, shortly before the patient presents to the operating room. The preoperative discussion taking place much in advance of surgery allows for the patient to understand the benefits of regional anesthesia and to be mentally prepared for this process. It is ideal for the regionalist to meet with the patient to explain the procedure, risks, and benefits, along with alternatives for the patient. The key tenet to this discussion is clear communication between the patient and the periopera-

tive physician in a concise and comfortable manner, allowing to empower the patient to be an important part of the perioperative process and not a passive participant in their choices for medical care.

Billing and Coding for Regional Anesthesia

The approach of the provider is to prepare a business model keeping in mind the customers, investors, and suppliers [48]. With regard to customer, both the patient and surgeon will need to be on board with the idea of nerve blocks in order for a successful regional program to operate.

It is important to take a hands-on approach to billing in order to maximize the amount of revenue generated for the hospital and the anesthesiology group. There is significant variability in reimbursement of regional anesthesia procedures for postoperative pain management and even between carriers within a certain region and across different regions [49].

From a billing perspective, a bona fide separate procedure note must be generated. Key points must be present in order to facilitate reimbursement success for claims. Detailed information includes requesting surgeon, indication of procedure, site of procedure, and technique. A key point to highlight is the distinction of block from the technique of anesthesia for the surgery, that is, to differentiate between postoperative analgesia from intraoperative techniques. For example, for a shoulder arthroscopic procedure, the interscalene nerve block must be clearly documented as for postoperative analgesia. The general anesthetic for the procedure would be the primary anesthetic in the intraoperative phase of the patient’s care. From the anesthesiologist’s perspective, unbundling of the regional technique from the intraoperative anesthetic is key for accurate and productive billing and may improve denial rate [50]. An additional way to highlight the distinction for postoperative analgesia from intraoperative care

is to have a separate team providing the block. If a separate practitioner is not possible, then ensure that the block is performed in a separate location from the anesthetizing location [17].

It is of crucial importance to document the number of locations that the regional anesthesiologist is performing. More than four sites categorize the physician as *supervising* as opposed to *medically directing*, a redesignation that would lead to decreased reimbursement for anesthesia services. When evaluating billing for regional techniques, it is important to document the type of anesthetic technique for surgery. If the regional technique will be the sole anesthetic, then the block will be reimbursed as part of the global anesthetic fee; if another form of anesthesia is the primary type (general or neuraxial), then the nerve block should be billed as charge modifiers to the anesthetic fee. That is, these procedures are not billed by time units but by units assigned to blocks.

It is important to have a basic understanding of the costs, charges, and payments as they pertain to regional anesthesia in the implementation and execution of a regional anesthesia team [49]. Certain key concepts, while in colloquial use, are important to define, as financial viability is explored. *Cost* is the capital to buy resources to perform PNB, including salary of those performing the block. *Charges* reflect the hospital billing of the regional technique to the patient, which is generally more than the actual procedure costs. *Payment* is the amount of

money received by the payer, which is usually a percentage of the charge and is determined by the payment schedule and payer mix. The payment or reimbursement should exceed the cost to maintain a fiscally efficacious practice model and to demonstrate viability to key stakeholders.

In order to maximize payments, familiarity with CPT codes and their relative value is important. CPT codes are utilized for submitting billing based on target nerve and specific block performed. Use modifiers like -59 to show that a peripheral nerve block is a distinct service, independent of other anesthetic services performed. If a procedure is performed bilaterally, the -50 modifier is used. The -51 modifying code is utilized for multiple blocks. Ultrasound guidance is billed with a separate and CPT code 76942. To appropriately use this code, the provider must document needle placement and image interpretation with a copy retained of the ultrasound image that highlights relevant sonographic anatomy and spread of local anesthetic. Patients may be continued with their peripheral nerve analgesic regimen with an infusion postoperatively, continuous peripheral nerve blockade (CPNB). This catheter system requires daily management of the patient to ensure analgesia and to evaluate for complications. E/M management codes are utilized for the daily management. Commonly used CPT codes and ICD-10 pain diagnosis codes are listed in Tables 2.1 and 2.2 [51].

Table 2.1 Anesthesia billing codes (CPT)

Type of block	Single shot	Catheter
Interscalene	64415	64416
Supraclavicular	64415	64416
Infraclavicular	64415	64416
Axillary	64417	64416
Femoral	64447	64448
Sciatic	64445	64446
Fascia iliaca	64447	64448
Lumbar plexus	64483	64449
TAP	64486/64488(bilateral)	64487/64489(bilateral)
Ultrasound guidance		76942

Table 2.2 ICD-10 pain diagnosis codes

Shoulder	M25.511	Pain in the right shoulder
	M25.512	Pain in the left shoulder
	M25.519	Pain in an unspecified shoulder
Upper arm/ elbow	M25.521	Pain in the right elbow
	M25.522	Pain in the left elbow
	M25.529	Pain in an unspecified elbow
Forearm/ wrist	M25.531	Pain in the right wrist
	M25.532	Pain in the left wrist
	M25.539	Pain in an unspecified wrist
Hand	M79.643	Pain in an unspecified hand
	M79.646	Pain in an unspecified finger(s)
Hip/thigh	M25.551	Pain in the right hip
	M25.552	Pain in the left hip
	M25.559	Pain in an unspecified hip
Knee/leg	M25.561	Pain in the right knee
	M25.562	Pain in the left knee
	M25.569	Pain in an unspecified knee
Foot/ankle	M25.571	Pain in the right ankle and joints of the right foot
	M25.572	Pain in the left ankle and joints of the left foot
	M25.579	Pain in an unspecified ankle and joints of an unspecified foot

Future Directions

Regional anesthesia techniques arm the anesthesiologists with tools to improve patient care and to advocate for fiscally sound choices for health-care administration. The value will need to be demonstrated to key stakeholders in the health-care paradigm. The perioperative home along with ERAS and ERPs is the key future direction for care of surgical patients. A way to directly document the powerful role that regional anesthesia has in the promulgation of these pathway is to compare ERPs that contain regional techniques with those that do not have it. The documented cost savings for pain medications, comparative incidence of PONV, and shorter time to discharge would lead credence to incorporating regional anesthesia as beneficial from value and cost-benefit purposes. These benefits make anesthesiologists poised to be the leaders

of present and future patient care settings to provide the best possible value-driven care for patients.

Review Questions

- Economic evaluations allow for comparisons of both costs and effects of an intervention. Which of the following is not part of this economic evaluation?
 - Cost minimization
 - Cost-effectiveness
 - Cost value
 - Cost benefit
 - Cost utility

Answer: c) Cost value

Cost minimization involves evaluating two alternative approaches in a process to reach an endpoint. This model strictly evaluates cost differential. Cost-effectiveness involves evaluating two alternatives, assessing their endpoints, and comparing the costs of achieving the differing endpoints. Cost utility allows for multiple outcomes (risks and benefits) combined into one measure. Cost-benefit evaluation analysis takes outcomes and translates them into financial outcomes, represented as dollar equivalents. Cost value is not a term used in economic evaluation.

- A 57-year-old obese patient with a history of OSA on CPAP is receiving an ultrasound guided b/l TAP block for an abdominal hysterectomy in order to minimize postoperative pain and the need for IV narcotics given her obesity and OSA history. Which of the following modifiers would reflect that this procedure is being performed bilaterally with the use of ultrasound?
 - 59, 76942
 - 50, 76942
 - 49, 76940
 - 59, 76942
 - 50, 76940

Answer: b) -50, 76942

In order to maximize payments, familiarity with CPT codes and their relative value is important. CPT codes are utilized for submitting billing based on target nerve and specific

block performed. Use modifiers like -59 to show that a peripheral nerve block is a distinct service, independent of other anesthetic services performed. If a procedure is performed bilaterally the -50 modifier is used. The -51 modifying code is utilized for multiple blocks. Ultrasound guidance is billed with a separate and CPT code 76942.

3. Which of the following has *not* been shown to be a cost-effective benefit of performing a regional anesthetic?
- Opioid-sparing effect
 - Decreased PONV
 - Earlier discharge to home
 - Reduced parasympathetic activation
 - Avoidance of general anesthesia in patients with respiratory pathology

Answer: d) Reduced parasympathetic activation

One of the significant sources of increased healthcare costs and decreased patient benefit after any surgical procedure is the persistence of debilitating pain along with the presence of postoperative nausea and vomiting (PONV). A regional anesthesia approach in the perioperative setting has decreased the complications from general anesthesia, leading to improved VAS scores, less PONV, decreased IV opioid use leading to an *opioid-sparing effect*, earlier discharge, and less risk of hospital readmission.

The stress response is in reference to the hormonal and metabolic changes which follow surgery. Regional anesthesia will prevent the endocrine and metabolic responses to surgery **decreasing sympathetic activation**. Both afferent input from the operative site to the central nervous system and the hypothalamic-pituitary axis and efferent autonomic neuronal pathways to the liver and adrenal medulla are blocked with epidural analgesia.

4. Which of the following has been shown to reduce ACT time as it relates to performing a regional anesthetic?
- Performing the time-out in the preop area
 - Having an efficient janitorial staff in between cases
 - The use of a designated block room

- Decreasing surgical operating times
- Using a faster-acting local anesthetic

Answer: c) The use of a designated block room

Efficient management of operating rooms requires an understanding and analysis of the times needed for all components of surgical care. Two terms used when looking at anesthesia time in the operating room include anesthesia-controlled time (ACT) and turnover time (TOT).

TOT = time (min) from previous patient out of the room to the next patient in the room

ACT = time (min) from surgical closure to out of the room with previous patient + time (min) from the next patient in the room to anesthesia ready

The use of a “block room” where regional anesthesia procedures can be performed prior to the intended surgery may serve to reduce ACT and allow for expedient patient surgical preparation from an anesthesia perspective. The parallel workforce may inherently operate in a smoother fashion in academic settings where there are residents or in private settings where there are teams of anesthesiologists, nurse anesthetists, and anesthesia assistants working within their respective scope of practice, with the anesthesiologist as the leader of the team. Additionally, the block room enables a controlled environment where equipment and dedicated supplies are readily available.

Preparing premade kits can help with efficiency, along with creating a cart in which all the equipment necessary for procedures are located. The mobility of this unit may allow for an easy transport to the bedside in different service locations. In order to provide a safe environment, resuscitative medication or a crash cart should also be available per medical center/surgery center policy.

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