Regional Anesthesia and Pain

Brachial plexus anesthesia compared to general anesthesia when a block room is available

[L'anesthésie du plexus brachial comparée à l'anesthésie générale quand une salle de bloc est disponible]

Kevin P.J. Armstrong MD, Richard A. Cherry MD

Purpose: Regional anesthesia is often felt to be beneficial to patient care but detrimental to operating room (OR) efficiency. In this report we compare how a block room (BR) affects OR time (ORT) utilization for brachial plexus anesthesia (BPA) in a busy upper limb practice. We also compare how anesthetic technique, BPA or general anesthesia (GA), impacts on the time to recovery and discharge in patients having outpatient upper limb surgery.

Methods: With the Ethics Committee's approval, a prospective study using hospital databases was undertaken. All patients presenting for surgery on the upper limb between November 1999 and April 2000 were eligible for analysis. A comparison was made of the various time intervals that comprise a patient's hospital stay for either GA or BPA. Demographic data (ASA, age, outpatient status), and location of BPA were analyzed.

Results: Use of the BR for BPA significantly reduced the pre-procedure anesthesia ORT when compared to BPA done in the OR (11.4 vs 32.9 min, $P < 0.05$; GA pre-procedure time was 17.8 min). In the ambulatory patient, BPA alone reduced post procedure anesthesia ORT, postanesthetic care unit, surgical day care unit, and total hospital times when compared to those receiving GA. On average those receiving a BPA spent 1.5 hr less in hospital ($P < 0.01$). Additionally, fewer admissions (2.4 vs 5.4%) occurred in the BPA group.

Conclusion: The use of a BR reduces the anesthesia ORT associated with BPA. Secondly, BPA improves the recovery time phase of outpatients undergoing surgery on the upper limb.

Objectif : L'anesthésie régionale semble souvent bénéficier au patient, mais nuire à l'efficacité de la salle d'opération (SO). Nous montrons comment la présence d'une salle de bloc (SB) influence le temps d'utilisation de la SO (TSO) pour l'anesthésie du plexus brachial (APB) dans un centre où les opérations des membres supérieurs sont nombreuses. Aussi, comment la technique anesthésique, l'APB ou l'anesthésie générale (AG), agit sur le temps de récupération et de séjour à l'hôpital en chirurgie ambulatoire des membres supérieurs.

Méthode : Une étude prospective a été réalisée, avec l'accord du Comité d'éthique, à partir des bases de données de l'hôpital. Tous les cas opérés aux membres supérieurs entre novembre 1999 et avril 2000 ont été soumis à notre analyse. Nous avons comparé les divers intervalles de temps compris dans le séjour d'un patient qui a reçu une AG ou une APB. Les caractéristiques des patients (état physique ASA, l'âge, le statut ambulatoire) et l'endroit où a été fait l'APB ont été analysés.

Résultats : L'APB réalisée en SB a réduit le TSO anesthésique préopératoire de façon significative, comparé à l'APB réalisée en SO (11,4 vs 32,9 min, $P < 0,05$; le temps préopératoire d'une AG a été de 17,8 min). Chez le patient ambulatoire, l'APB a réduit à elle seule le TSO anesthésique postopératoire, le temps en salle de réveil et à l'unité de chirurgie d'un jour, et le temps de séjour total en comparaison avec le patient d'AG. En moyenne, avec l'APB on passe 1,5 h de moins à l'hôpital ($P < 0,01$). En outre, il y a moins d'hospitalisation (2,4 vs 5,4 %) avec l'APB.

Conclusion : L'utilisation d'une SB réduit le TSO anesthésique associé à l'APB. De plus, l'APB réduit le temps de récupération des patients de chirurgie ambulatoire des membres supérieurs.

From the Department of Anesthesia and Perioperative Medicine, University of Western Ontario, London, Ontario, Canada.

Address correspondence to: Dr. Kevin P.J. Armstrong, Department of Anesthesia and Perioperative Medicine, University of Western Ontario, St. Joseph's Health Care London, 268 Grosvenor St., London, Ontario N6A 2V4, Canada. Phone: 519-646-6100; Fax: 519-646-6116; E-mail: Kevin.Armstrong2@sympatico.ca

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BRACHIAL plexus anesthesia (BPA) is a technique well suited to surgical procedures for the upper limb. Side effects associated with general anesthetics (GA), namely nausea, vomiting, sedation and poor pain control¹ are possibly reduced with regional anesthesia (RA).² The use of BPA is highly variable and is often specific to the institution or anesthesiologist. Inefficient use of operating room time (ORT) is often cited as a reason for avoiding this mode of anesthesia. In this report we illustrate how the use of BPA with a block room (BR) reduces anesthesia ORT use. We also compare the recovery times for patients receiving GA or BPA.

Methods

With the Ethics Committee's approval, a prospective, six-month study was carried out. Neither randomization nor blinding of patients was attempted. A Canadian, academic, combined plastic/orthopedic practice at St Joseph's Health Care London (SJHC) was the lone site. This service performs approximately 2,500 upper extremity operations annually. Electronic OR records were generated (Surgi-Server 2000, HBOC Serving Software Group Minneapolis, MN, USA) at the time of surgery. Prior to commencement of data collection specific RA data pages were developed. Primary data included age, American Society of Anesthesiologists (ASA) physical status, BPA technique, BPA start and stop time, BR entry, BR exit, OR entry,

TABLE I Demographic data for patients undergoing upper limb surgery, analyzed over a six-month period

Anesthesia technique	General anesthesia (GA)	Brachial plexus anesthesia (BPA)	Combined GA and BPA
Number	704	173	143
Age in yr	41(1-93)	52 (13-90)	46 (5-87)
- 1 (%)	283 (40.2)	67 (38.7)	49 (33.6)
- 2	297 (42.3)	84 (48.6)	83 (56.8)
ASA - 3	77 (10.9)	15 (8.7)	11 (7.5)
- 4	15 (2.1)	0	0
- not recorded	32 (4.5)	7 (4.0)	3 (2.0)
Outpatient number (%)	323 (45.9)	130 (75.1)	59 (40.4)
Inpatient number (%)	381 (54.1)	43 (24.9)	87 (59.6)
Block room used	0	90	85
OR used for BPA	N/A	83	61
Time in BR when used	N/A	45.4 ± 18	48.5 ± 19
Shoulder/humerus	171*	3	79
Elbow/forearm	158*	15	34
Wrist/hand	312*	155	33
Discharged to SDCU	0	92	1
Discharged to PACU	693**	81	142
Procedure time (global)	99.4 ± 46	80.0 ± 38	113.0 ± 57
PACU time (global)	118.2 ± 56	72.5 ± 43	120.0 ± 78
Procedure time (outpatient)	93 ± 27	93 ± 25	-----
PACU time (outpatient)	77.5 ± 43	62.0 ± 24	-----
SDCU time (outpatient)	110	PACU bypass 95 PACU 83	-----
Total hospital time	426 ± 84	342 ± 60	-----

All data for GA are significantly different ($P < 0.05$) compared to BPA with the exceptions of age, procedure time and surgical day care unit (SDCU) time for outpatients. *Sixty-three procedures completed under GA could not be identified as solely shoulder/humerus, elbow/forearm, or wrist/hand. **Eleven patients in the GA group were discharged to the intensive care unit. All times are in minutes. Postanesthetic care unit = PACU; OR = operating room; BR = block room.

TABLE II A comparison of various operating room time (ORT) intervals, depending on anesthetic technique and/or location

Anesthesia	General anesthesia	Brachial plexus anesthesia (BPA)	BPA in OR	BPA in block room
Pre-procedure anesthesia ORT	17.8*	21.7	32.9*§	11.4*§
Procedure time	99.4*§	80.0*	85.1	75.3§
Postprocedure anesthesia ORT	7.5*§	3.9*	4.1	3.6§
Total anesthesia ORT	25.3*	25.6	37.1*§	15.1*§

All times in minutes. BPA represents a composite of all BPA cases initiated in the block room (BR) or the OR. * $P < 0.05$; § $P < 0.05$.

FIGURE 1 Composition of outpatient hospital stay for procedures lasting one to three hours
Recovery includes regional anesthesia (RA) patients discharged to postanesthetic care units (PACU) and surgical day care units (SDCU; $n = 81$). Admitted patients ($n = 2$) are not included. PACU includes only RA patients discharged to PACU ($n = 25$). SDCU Reg are patients discharged to SDCU from PACU ($n = 56$). Error bars indicate 95% confidence intervals.

procedure start, procedure end, OR exit, postanesthetic care unit (PACU) entry, and PACU exit. Time intervals, which comprise the perioperative time course, were then calculated (time in the BR, time to perform the BPA, pre-procedure anesthesia ORT, procedure time and postprocedure anesthesia ORT). Patients “fast tracked” (BPA only) directly to surgical day care unit (SDCU) were identified. Secondary data included the anesthesiologist, in/out patient status, and delay codes if any. Hospital length of stay (LOS) was determined through examination of health records data. Hospital stay was divided into three phases: 1) the preparation phase (admission to procedure start); 2) the procedure; and 3) the recovery phase (procedure end to discharge from PACU or SDCU).

Database records were checked electronically for breach of case eligibility (procedure codes and text scans of procedure descriptive fields), case duplication, omission of key fields, and incongruent time entries. Outpatients admitted to the hospital or those with a protracted LOS had their chart reviewed to ascertain the reason for admission or to ensure accuracy of time entries.

Between November 1999 and April 2000 all cases performed by any of nine surgeons, and of a specific procedure type, were considered eligible for analysis. These included procedures on the shoulder, humerus,

FIGURE 2 Total hospital time for outpatients with a procedure lasting one to three hours

Scattergrams of the total time spent in the hospital for outpatients undergoing surgery on the upper limb. Each data point represents a patient.

elbow, forearm, wrist and hand. Intravenous RA, monitored anesthesia care, or purely local anesthesia cases were excluded. Cases outside regular hours were included.

Choice of anesthesia for each patient was entirely at the discretion of the attending anesthesiologist. There was no standardization of BPA or GA technique. BPA occurred in the BR or OR based on availability of the patient, house staff, and nursing staff. Each bay of the BR has monitoring capabilities [blood pressure, electrocardiogram, O_2 Sat]. Supplementary oxygen is available, as is resuscitation equipment and drugs. This BR also serves as a staging area for patients undergoing ophthalmologic procedures as well as other RA activity.

Statistical analysis

Groups were analyzed with t test where appropriate. In the absence of homoscedasticity among groups, non-parametric testing (Kruskal-Wallis) was used with post hoc testing (Wilcoxon) to determine statistical differ-

ence between multiple groups. A *P* value of 0.05 was considered to be significant.

Results

Of the 1,023 cases identified as valid for analysis, 319 (31.2%) received a BPA. 16.6% (173) of these were performed under BPA alone while 14.3% (146) had a combined BPA/GA technique. GA accounted for 69.4% of cases. Outpatients represented 75.1% of the BPA group, 45.9% of the GA and 40.4 of the BPA/GA group. BPA technique consisted of an axillary or interscalene block.

Perioperative time course

Anesthesia ORT (pre-procedure, postprocedure and total) as well as recovery times are presented in Table II. BPA use allowed 92 of 173 (53%) outpatients to go directly to SDCU. Analysis of outpatients with similar procedure times (Figure 1) revealed that BPA resulted in a shorter PACU stay when compared to GA (*P* = 0.02). SDCU times were also reduced in the BPA group (Figure 1), both for those discharged directly to the SDCU and via PACU. Outpatients receiving BPA spent less time in the hospital and had a lower rate of admission. LOS variability within this subset of patients is greater in those receiving a GA (range 7.8 vs 5.2 hr).

Discussion

We have been able to show that a BR reduces the ORT anesthesiologists use to establish BPA at our centre. Space, anesthesia, and nursing resources are still needed for a BR to function. ORT is perhaps the most valued resource in the surgical model. It therefore stands to reason that where a large volume of RA is conducted a BR would be beneficial. By extension a BR would potentially have a greater benefit to sites with anesthesia training programs or anesthesia assistants.

Our findings, similar to others,³ indicate that the anesthetic technique has an influence on the recovery phase for upper limb procedures. When we controlled for procedure time in outpatients, GA resulted in longer PACU, SDCU, and hospital LOS (Figures 1 and 2). Some of this improvement may result from fast tracking of patients receiving BPA, but is not available to GA patients (all GA patients went to the PACU*). Side-effects associated with GA, namely nausea, vomiting, sedation and poor pain control² are possibly reduced with BPA⁴ and may contribute to this finding.

Limitations of this study are that it lacked randomization and was unblinded. Also, we utilized hospital databases. To reduce erroneous data this project was designed prospectively. Attempts to ensure accuracy at the point of entry and to confirm suspect data were made. As a result we feel the data are accurate.

In conclusion, we confirm that RA together with a BR reduces the anesthesia ORT associated with BPA. We also demonstrate how the use of RA can reduce the recovery time phase in upper limb ambulatory surgery.

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* At the time of this study sevoflurane, desflurane and remifentanyl were all available and used but we did not collect data on the composition of either anesthetic technique. Currently we still do not allow fast tracking of GA patients and fast tracking for RA patients is at the discretion of the anesthesiologist.