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General anesthesia versus ultrasound-guided axillary block for ambulatory hand surgery: randomized prospective study

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Abstract

Background: In upper limb surgery, both axillary brachial plexus block (ABPB) and general anesthesia (GA) have been widely used. ABPB is one of the most popular and widely used procedures for brachial plexus blocks, as well as for achieving upper limb regional anesthesia.

The aim of the study was to compare between both anesthetic techniques for ambulatory hand surgery regarding their effects on postoperative pain as primary outcome and postoperative nausea and vomiting and patient satisfaction and postoperative sleep disturbances as secondary outcomes.

Results: We reviewed data from 40 patients for the primary outcome and found that group A (had general anesthesia) had a statistically significant higher postoperative VAS score than group B (got ultrasound guided axillary block), (*P*-value 0.05). In terms of secondary outcomes, postoperative nausea and vomiting were significantly higher in group A patients (*P*-value 0.001), and patient satisfaction was significantly higher in group B patients compared to group A patients (*P*-value 0.001). Furthermore, the Pittsburgh quality index (PSQI) for postoperative sleep disruptions was considerably higher in group A than in group B at 24 h postoperatively and at the first and second weeks postoperatively (*P*-value 0.001). Statistically, there is no difference between the two groups in the third week and one month after surgery.

Conclusions: When compared to general anesthesia, ultrasound-guided axillary brachial plexus block offered good anesthesia, great analgesia, and a better postoperative sleep result after hand surgery.

Keywords: Axillary brachial plexus block, General anesthesia, Pain, Sleep

Background

Upper-extremity surgery has been successfully performed under general anesthesia (GA). It has a shorter induction time, but it is associated with a number of negative side effects, including surgical discomfort, nausea and vomiting, delayed hospital discharge, and postoperative sleep difficulties (Song et al. 2009). The axillary brachial plexus block is a different type of upper-extremity anesthesia. It has been linked to a lower incidence of postoperative discomfort, nausea, and vomiting (Chung et al. 2014). Furthermore, the use of regional anesthetic has been linked to cost savings for the health-care facility as well as increased patient satisfaction (Li et al. 2000). Many factors are implicated in postoperative sleep disruptions, including the severity of the surgical operation, the neuroendocrine response to surgery, and the requirement for

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opioids to alleviate postoperative pain (Finan et al. 2013). Unfortunately, opioid analgesia affects postoperative sleep by reducing slow-wave sleep (SWS), as well as causing dose-dependent REM suppression and arousals during sleep, by exerting influence over a variety of biological systems (Poulsen et al. 2018). Postoperative sleep disturbances can cause postoperative fatigue, metabolic problems, hypertension, cerebrovascular, and cardiovascular illness, in addition to being one of the signs of postoperative brain dysfunction (Horner and Peever 2017). As a result, it has been hypothesized that peripheral nerve blocks may be useful in addressing these issues (Bernards et al. 2008). Axillary brachial plexus block was thought to play a key role in reducing sleep problems after surgery by lowering the postoperative central apnea score and lowering narcotic intake (Urmey 2006).

This study compared the effects of both anesthetic procedures for ambulatory hand surgery on postoperative pain, postoperative nausea and vomiting, patient satisfaction, and postoperative sleep disruptions as primary and secondary outcomes, respectively.

Methods

This prospective randomized study was conducted at Ain Shams University hospitals. After approval of the Research Ethics Committee of Ain Shams University (FMASU MD186/2019), the study was registered at Clinical Trials.gov (NCT04727515). The study was carried out in surgery unit at university hospitals in period between December 2019 and March 2020. After we conducted a point-by-point clarification of studied techniques, a total of 45 patients, from both sex, aged 18–40 years with body mass index less than 30 planned for elective ambulatory hand surgery with expected time less than 90 min. Patients excluded were those with allergies to local anesthetic, those with ASAIII and IV, patients who refused to participate, alcohol or drug abuse, uncooperative or not highly educated patients, living alone, patients with no telephone available, and those who have bleeding disorders or on anticoagulant drugs. Patients with preoperative obstructive sleep apnea (OSA) or any sleep disturbances, or taking any sleep medications, and patients presenting with polytrauma or undergoing emergency operation were also excluded. All patients were reviewed by anesthesiologist on the same day of surgery for any medical history, ensuring fasting at least 8 h. The anesthesia plan was discussed with the patients and the patients signed a consent form and also informed about the use of visual analog scale and Likert scale. On arrival to the operation theatre, an 18-G cannula was inserted in the nonoperative arm, and lactated ringer solution was infused at rate 6 to 8 ml/kg. Monitors as non-invasive blood pressure (NIBP), electrocardiogram, and pulse oximetry (SpO_2) were applied, and basal readings were recorded. All patients were premedicated with midazolam IV 0.03 mg/kg.

Patients were divided into two equal groups at random; after exclusion of five patients, each group had twenty patients; the randomization approach was computer-generated randomized numbers, and allocation was hidden behind fixed dark envelops. The two groups were as follows: group A ($n=20$) in which patients received standard general anesthesia technique, and group B ($n=20$), in which patients received ultrasound-guided axillary block.

In group A, general anesthesia was induced. After preoxygenation, IV fentanyl 1–2 MIC/kg was given slowly, followed by IV propofol 1.5–2 mg/kg, which was slowly injected and titrated until the loss of verbal contact. The airway was managed with appropriately sized laryngeal airway mask. Patients continued to breathe spontaneously a mixture of isoflurane (end tidal up to 1.5 %) and oxygen in air in 50:50.

In group B, the patients received ultrasound-guided axillary block as the following: while the patient in the supine position with the arm abducted to approximately 90° with the hand resting on a pillow next to the head, and after skin disinfection, nerve location was performed using a 5-cm, 10 MHz linear probe (S-nerve ultrasound system, Fuji film sonosite, Bothell, WA). The transducer was positioned in the short axis orientation to identify the axillary artery about 1–3 cm from the skin surface. Once the artery was identified, localization of the hyperechoic median, ulnar, radial, and the musculocutaneous nerves was made. A 5-cm 22-gauge needle was advanced in line with the ultrasound beam until the tip was placed adjacent to each target nerve. Five milliliters of bupivacaine 0.5% was deposited around each target nerve.

Frequent aspiration and slow administration of local anesthetic was done to limit the risk of intravascular injection and systemic toxicity.

If no spread was seen on the ultrasound image despite local anesthetic injection, the tip of the needle may be in a vein. If this occurs, injection should be halted immediately, and the needle should be withdrawn slightly.

The limb was evaluated for block success every 3 min for the sensory block and every 5 min for the motor block. Sensory block was assessed using pinprick in the dermatomal areas supplied by the four main nerves (median nerve, radial nerve, ulnar nerve, and musculocutaneous nerve) (thenar eminence, dorsum of the hand, hypothenar eminence, and lateral side of forearm) (grade (0) sharp pain felt, grade (1) analgesia but dull sensation still felt, grade (3) complete anesthesia). The onset of sensory block was considered at grade (1) along the distribution of any of the above nerve areas while grade (2) refers to complete block. Motor block was assessed using

Table 1 PSQI score (Aloba et al. 2007)

Component 1: Subjective sleep quality—question 9	
Response to Q9	**Component 1 score**
Very good	0
Fairly good	1
Fairly bad	2
Very bad	3
Component 2: Sleep latency—questions 2 and 5a	
Response to Q2	**Component 2/Q2 subscore**
≤ 15 min	0
16–30 min	1
31–60 min	2
> 60 min	3
Response to Q5a	**Component 2/Q5a subscore**
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3
Sum of Q2 and Q5a subscores	**Component 2 score**
0	0
1–2	1
3–4	2
5–6	3
Component 3: Sleep duration—question 4	
Background	
> 7 h	0
6–7 h	1
5–6 h	2
< 5 h	3
Component 4: Sleep efficiency-questions 1, 3, and 4	
Sleep efficiency = (# hours slept* hours in bed) × 100%	
# hours slept—question 4	
# hours in bed—calculated from responses to questions 1 and 3	
Sleep efficiency	**Component 4 score**
> 85%	
75–84%	
65–74%	
< 65%	
Component 5: Sleep disturbance—questions 5b-5j	
Questions 5b to 5i should be scored as follows:	
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3
Sum of 5b lo 51 scores	Component 5 score
0	0
1–9	1
10–18	2
9–27	3
Component 6: Use of sleep medication—question 6	
Response to Q6	**Component 6 score**
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3
Component 7: Daytime dysfunction—questions 7 and 8	
Response to Q7	**Component 7/ Q7 sub score**
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3
Response lo Q8	**Component7/Q8 sub score**
No problem at all	0
Only a very slight problem	1
Somewhat of a problem	2
A very big problem	3
Sum of Q7 and Q8 sub scores	**Component 7 score**
0	0
1–2	1
3–4	2
5–6	3

modified Bromage scale (Malinzak 2009) for the upper limb by ability to flex the elbow and the hand against gravity. Patients were kept comfortable with arm by side, observed for signs of toxicity.

Nerve block was considered successful with regard to neurological examination when brachial plexus dermatomes were completely blocked. The block was considered to fail when sensory anesthesia was not achieved within 30 min. At the end of procedure, all patients were then transferred to postanesthetic care unit (PACU), where an anesthetist and a nurse unaware of study protocol observed the patients.

The patients were transferred to ward after achieving standard discharge criteria. The duration of sensory block was defined by noting the time when there was return of dull sensation to pinprick, and duration of motor block was defined as time interval between cessation of movement in the limb until patient is able to flex the elbow Bromage (1).

Pain scores were evaluated by a blinded observer anesthesiologist at the time of arrival in PACU and at 2, 4, 6, 12, 18, and 24 h thereafter using visual analog scale (VAS) measurement (5); patients were previously informed about VAS. VAS consists of line with the endpoints defining extreme limits such as "no pain at all" and "pain as bad as it could." The patient is asked to mark his pain level on the line between the two endpoints (ranging 0–10 cm, where 0 = no pain, 10 = worst pain) (Bird and Dickson 2001). The postoperative analgesic strategy

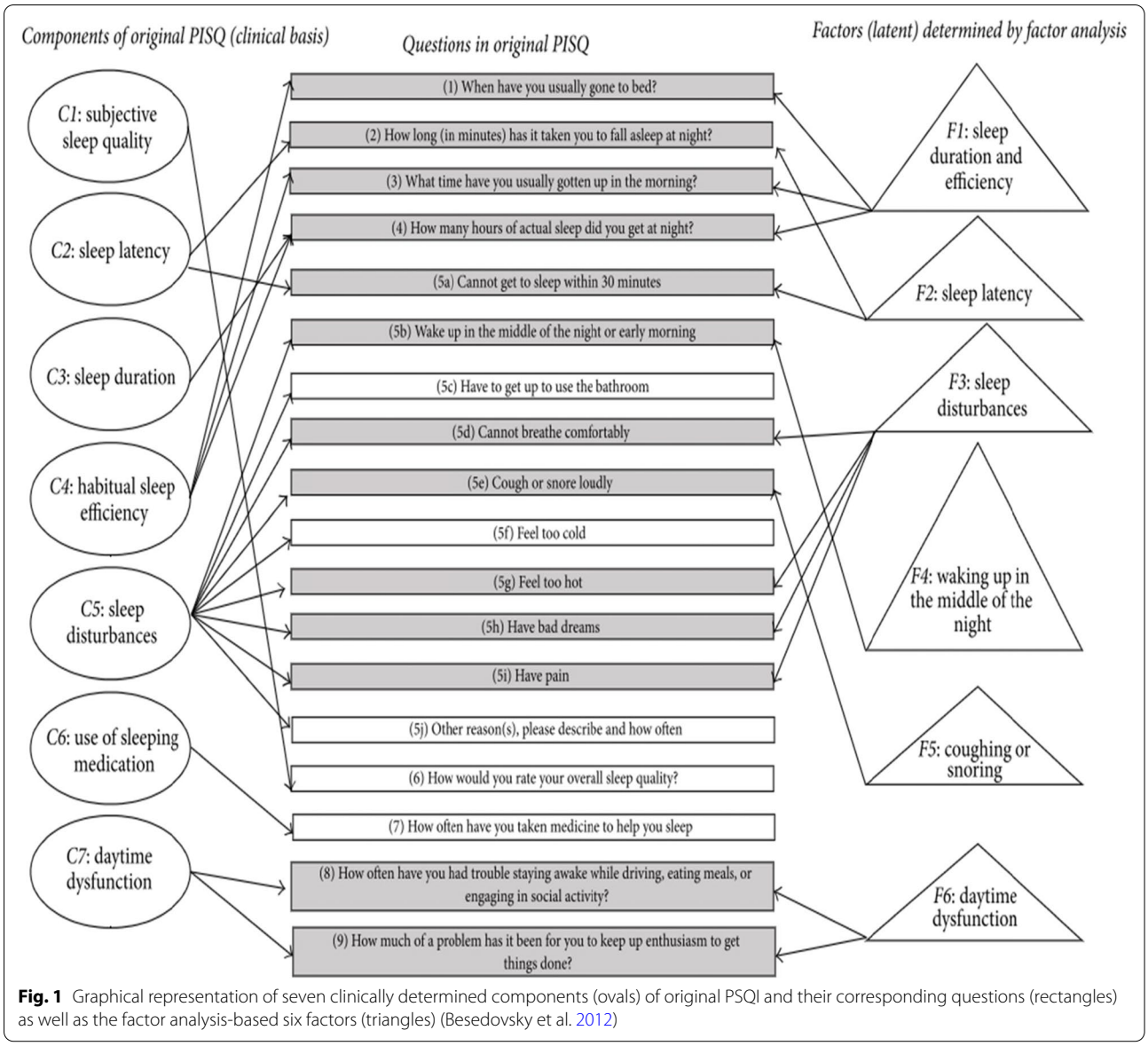

Fig. 1 Graphical representation of seven clinically determined components (ovals) of original PSQI and their corresponding questions (rectangles) as well as the factor analysis-based six factors (triangles) (Besedovsky et al. 2012)

depends on the prescribed oral analgesic (1 g paracetamol/8 h) and rescue analgesia in the form of morphine (2.5 mg was intravenously administered only at VAS (6)).

Postoperative nausea and vomiting (PONV) during the first 24 h were also recorded. PONV was treated with 0.1 mg/kg IV ondansetron. Patient satisfaction was checked after 24 h using five-point Likert scale in the ward by an anesthetist blind to the study, where 1 = excellent, 2 = very good, 3 = good, 4 = fair, and 5 = poor (Heiberger and Robbins 2014).

Postoperatively (first 24 h), sleep disturbance was evaluated using the Pittsburgh sleep questionnaire (Aloba et al. 2007).

The Pittsburgh Sleep Quality Index is a standardized self-administered questionnaire for the assessment of subjective sleep quality. The Pittsburgh Sleep Quality Index (PSQI) is the most commonly used retrospective self-report questionnaire that measures sleep quality over the previous month and used as screening for sleep disturbances. We asked patients or one of his close relatives through phone at 24 h postoperatively and every week for the first month after the operation (Table 1).

The PSQI examines seven components of sleep quality retrospectively over a period of 4 weeks: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction over the last month. Scoring of answers is based on a 0–3 scale, whereby "3" reflects the negative extreme. The global score is generated by

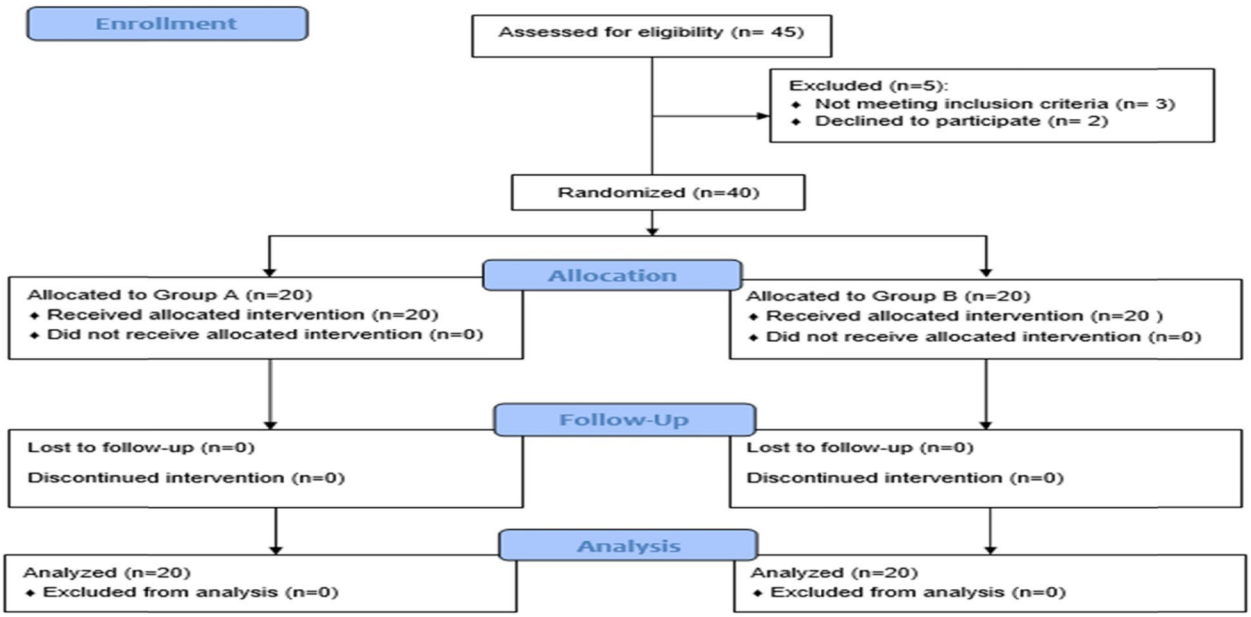

Fig. 2 Consort flow diagram

summing up all seven component scores and ranges from 0 to 21, with higher values corresponding to reduced sleep quality (Fig. 1).

Statistical analysis

Using the STATA program, alpha error at 5% and power at 80% were set. The result from previous study (Vincent et al. 2001) show that nausea and vomiting were present in 62% of cases in the GA group compared to 18% in the axillary group. Based on this condition, the needed sample is 20 cases per group (40 patients).

Recorded data were analyzed using the Statistical Package for Social Sciences (SPSS), for Windows (version 10) (SPSS Inc., Chicago, IL, USA). Quantitative data are presented as mean ± standard deviation (SD), and independent *t*-test or Mann-Whitney *U* test was used as a test of significance. Qualitative data were presented as frequencies and percentages. Chi-square (χ^2) test was used as a test of significance. A *P* value ≤ 0.05 was considered significant.

- *P*- value: level of significance
- $P < 0.05$: significant (S)
- $P < 0.01$: highly significant (HS)
- $P > 0.05$: non-significant (NS)

Table 2 Comparison between group A and group B regarding demographic data

Demographic data	Group A ($n = 20$)	Group B ($n = 20$)	Test	*P*-value
Age (years)				
Range	18–40	18–40	$t = 0.263$	0.794
Mean ± SD	29.87 ± 6.68	30.39 ± 5.77		
Sex				
Male	13 (65.0%)	15 (75.0%)	$\chi^2 = 0.119$	0.730
Female	7 (35.0%)	5 (25.0%)		
BMI [wt/(ht)^2]				
Range	24–29	23–29	$t = 0.318$	0.753
Mean ± SD	26.30 ± 2.19	26.08 ± 2.19		
ASA				
I	14 (70.0%)	16 (80.0%)	$\chi^2 = 0.133$	0.715
II	6 (30.0%)	4 (20.0%)		

Data are expressed mean and SD standard deviation and number and percentage%

T-independent sample *t*-test; χ^2 chi-square test; *P*-value> 0.05 was considered non-significant

Table 3 Comparison between group A and group B regarding type of surgery

Type of surgery	Group A ($n=20$)	Group B ($n=20$)	χ^2	*P*-value
Tendon	3 (15.0%)	4 (20.0%)	1.032	0.960
Amputation	1 (5.0%)	1 (5.0%)		
Fracture fixation	4 (20.0%)	5 (25.0%)		
Arthrodesis	1 (5.0%)	2 (10.0%)		
Hardware removal	2 (10.0%)	1 (5.0%)		
Nerve repair	4 (20.0%)	3 (15.0%)		
Miscellaneous	5 (25.0%)	4 (20.0%)		

Data are presented as number (%)

χ^2 chi-square test; *P*-value > 0.05 was considered non-significant

Results

A total of 45 patients were recruited for the study. Three patients were excluded from the study because they did not match the inclusion criteria, and two patients refused to participate in the study. Finally, 40 patients participated and successfully completed the study. They were randomly allocated into two groups, twenty patients each (Fig. 2).

Regarding demographic data (age, sex BMI, and ASA status) (Table 2) and type of surgeries (Table 3), there was no statistically significant difference between both groups.

Pain scores were significantly higher in group A in comparison to group B at 6, 12, and 18 h postoperatively. There was no significant difference between both groups immediately postoperatively and at 2, 4, and 24 h after that (Table 4 and Fig. 3).

Table 4 Comparison between group A and group B regarding visual analog scale

Visual analog scale	Group A ($n=20$)	Group B ($n=20$)	*z*-test	*P*-value
Immediate postoperative	1 (0–2)	0 (1–1)	1.679	0.296
After 2 h	2 (1–3)	1 (0–2)	1.839	0.201
After 4 h	3 (2–4)	2 (1–3)	1.932	0.141
After 6 h	4 (3–5)	1 (0–2)	3.356	0.036*
After 12 h	5 (2–4)	2 (1–3)	4.869	0.013*
After 18 h	4 (3–5)	3 (2–3)	3.865	0.022*
After 24 h	2 (1–3)	2 (1–3)	0.691	0.312

Data are presented as median (IQR)

z-Mann-Whitney test; *P*-value> 0.05 was considered non-significant; **P*-value < 0.05 was considered significant

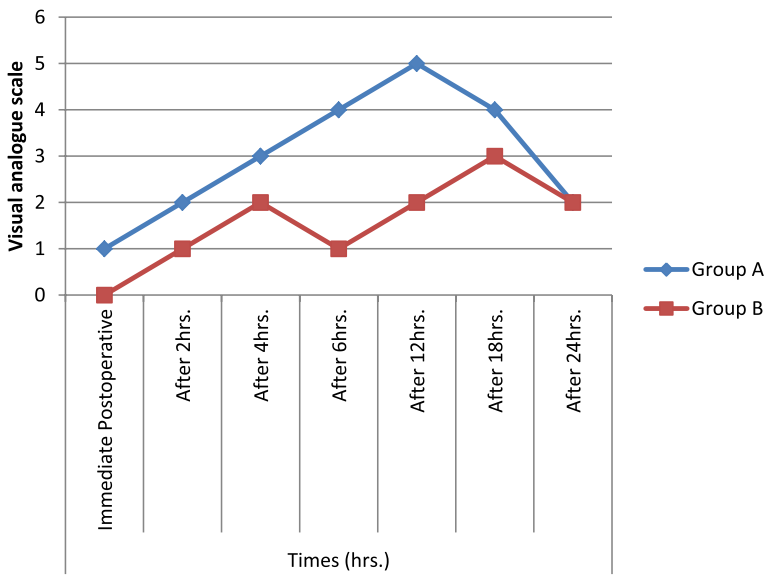

Fig. 3 Comparison between group A and group B according to visual analog scale

Table 5 Comparison between group A and group B regarding PONV

	Group A ($n=20$)	Group B ($n=20$)	χ^2	*P*-value
PONV	17 (85.0%)	2 (10.0%)	21.992	< 0.001**
None	3 (15.0%)	18 (90.0%)		
Mild	*4 (23.5%)*	*1 (50.0%)*		
Moderate	*11 (64.7%)*	*1 (50.0%)*		
Severe	*2 (11.8%)*	*0 (0.0%)*		

Data are presented as number (%)

χ^2 chi-square test; ***P*-value < 0.001 was considered highly significant

Table 6 Comparison between group A and group B regarding patients satisfaction

Patient satisfaction	Group A ($n=20$)	Group B ($n=20$)	χ^2	*P*-value
Poor	2 (10.0%)	0 (0.0%)	21.714	< 0.001**
Fair	2 (10.0%)	0 (0.0%)		
Good	12 (60.0%)	2 (10.0%)		
Very good	4 (20.0%)	10 (50.0%)		
Excellent	0 (0.0%)	8 (40.0%)		

Data are presented as number(%) χ^2 chi-square test; ***P*-value < 0.001 was considered highly significant

Regarding PONV, patients in group A experienced more PONV than patients in group B.

Patient satisfaction were significantly higher among patients in group B than group A using the five-point Likert scale.

Regarding postoperative sleep disturbance, PSQI was significantly higher among patients in group A than among patients in group B at 24 h postoperatively and at the first and second weeks postoperatively (*P*-value < 0.05), although there is no statistically difference between both groups at 3 weeks and at 1 month postoperatively (Tables 5, 6, 7, 8, 9, 10, and 11).

Discussion

The purpose of this study was to compare the effects of general anesthesia with axillary block in patients undergoing upper limb procedures below the mid-humerus. The key conclusion was that an axillary block guided by ultrasonography can offer good postoperative analgesia, lower the risk of PONV, improve patient satisfaction, and reduce the incidence of sleep disturbance after surgery. Upper-extremity surgery has been successfully performed under general anesthesia (GA). Although GA has a shorter induction time, it has certain disadvantages, including decreased cardiac output, central nervous system depression, respiratory depression, and substantial doses of intraoperative and postoperative opioid analgesia. Opioids are often linked to an increase in nausea and vomiting, as well as postoperative hyperalgesia, which can lead to increased pain severity and consequent sleep problems (Song et al. 2009).

Upper limb surgeries, particularly hand surgeries, are frequently conducted as outpatient procedures, with peripheral blocks such as the axillary brachial plexus block being the most prevalent. Peripheral nerve blocks provide intraoperative anesthetic as well as postoperative analgesia without causing substantial systemic side effects by lowering stress levels and utilizing less anesthetic medicines (Coluzzi et al. 2011). The axillary brachial plexus block is a popular nerve block for forearm, wrist, and hand surgery because it gives regional anesthetic and is conducted away from the pleura and neuraxial tissues, which reduces the risk of problems when compared to other brachial plexus blocks (Hadzic and Vloka 2004).

The primary goal of this research is to compare the effects of general anesthetic versus ultrasound-guided axillary block on postoperative pain, PONV, patient satisfaction, and sleep disturbances.

Following ambulatory surgery, postoperative discomfort is the major cause of unplanned hospital admission.

Table 7 Comparison between group A and group B regarding Pittsburgh sleep questionnaire after 24 h postoperative

Pittsburgh sleep questionnaire after 24 h postoperative	Group A ($n=20$)	Group B ($n=20$)	*t*-test	*P*-value
Subjective sleep quality	1.85 ± 0.54	1.35 ± 0.40	3.327	0.002*
Sleep latency	2.57 ± 0.75	0.96 ± 0.28	8.994	< 0.001**
Sleep duration	2.14 ± 0.63	0.86 ± 0.25	8.446	< 0.001**
Habitual sleep efficiency	2.03 ± 0.59	1.53 ± 0.45	3.013	0.005*
Sleep disturbances	1.96 ± 0.57	1.56 ± 0.46	2.442	0.019*
Use of sleep medications	1.93 ± 0.56	0.86 ± 0.25	7.803	< 0.001**
Daytime dysfunction	1.09 ± 0.32	1.66 ± 0.49	4.356	< 0.001**

Data are expressed mean ± SD

t-independent sample *t*-test

**P*-value < 0.05 was considered significant; ** *P*-value < 0.001 was considered highly significant

Table 8 Comparison between group A and group B regarding Pittsburgh sleep questionnaire after 1 week postoperative

Pittsburgh sleep questionnaire after 1 week	Group A ($n=20$)	Group B ($n=20$)	*t*-test	*P*-value
Subjective sleep quality	1.61 ± 0.47	1.20 ± 0.35	3.129	0.003*
Sleep latency	2.23 ± 0.65	0.86 ± 0.25	8.798	< 0.001**
Sleep duration	1.86 ± 0.54	0.76 ± 0.22	8.437	< 0.001**
Habitual sleep efficiency	1.77 ± 0.52	1.36 ± 0.40	2.795	0.008*
Sleep disturbances	1.71 ± 0.50	1.39 ± 0.41	2.213	0.033*
Use of sleep medications	1.68 ± 0.49	0.76 ± 0.22	7.660	< 0.001**
Daytime dysfunction	0.95 ± 0.28	1.48 ± 0.43	4.619	< 0.001**

Data are presented as mean ± SD

t-independent sample *t*-test

**P*-value < 0.05 was considered significant; ***P*-value < 0.001 was considered highly significant

Table 9 Comparison between group A and group B regarding Pittsburgh sleep questionnaire after 2 week postoperative

Pittsburgh sleep questionnaire after 2 weeks	Group A ($n=20$)	Group B ($n=20$)	*t*-test	*P*-value
Subjective sleep quality	1.40 ± 0.41	1.07 ± 0.31	2.871	0.007*
Sleep latency	1.72 ± 0.50	0.76 ± 0.22	7.859	< 0.001**
Sleep duration	1.43 ± 0.42	0.68 ± 0.20	7.210	< 0.001**
Habitual sleep efficiency	1.46 ± 0.30	1.21 ± 0.25	2.863	0.007*
Sleep disturbances	1.49 ± 0.43	1.22 ± 0.36	2.153	0.038*
Use of sleep medications	1.29 ± 0.38	0.68 ± 0.20	6.353	< 0.001**
Daytime dysfunction	0.83 ± 0.24	1.32 ± 0.39	4.903	< 0.001**

Data are presented as mean ± SD

t-independent sample *t*-test

**P*-value < 0.05 was considered significant; ***P*-value < 0.001 was considered highly significant

At 6, 12, and 18 h after surgery, group A had a statistically significant higher VAS than group B in our study. However, no statistically significant difference existed between the two groups immediately after surgery and at 2, 4, and 24 h later.

Our findings were comparable to those of Lee et al. (2014), who discovered that patients who had axillary brachial plexus block had lower VAS scores at 2 and 6 h following surgery than those who received general anesthesia. However, after 6 h, the VAS scores in both groups were equal.

Furthermore, patients who received the ultrasound-guided axillary block had lower VAS pain scores than patients who received the GA (median (IQR), 0.3 (1.3) vs 55.8 (36.5), *P*-value 0.001) and visual rating scale pain scores at 2 h (0.3 [1.3] vs 45 [29.6], *P*-value 0.001) and at 6 h (1.1 [2.7] vs 4 [2.8], *P* -value 0.01) (O'Donnell et al. 2009). At 2 and 6 h after surgery, pain levels in the

Table 10 Comparison between group A and group B regarding Pittsburgh sleep questionnaire after 3 weeks postoperative

Pittsburgh sleep questionnaire after 3 week	Group A ($n=20$)	Group B ($n=20$)	*t*-test	*P*-value
Subjective sleep quality	1.02 ± 0.30	0.95 ± 0.28	0.763	0.450
Sleep latency	0.76 ± 0.22	0.68 ± 0.20	1.203	0.236
Sleep duration	0.67 ± 0.20	0.60 ± 0.18	1.163	0.252
Habitual sleep efficiency	1.18 ± 0.35	1.08 ± 0.32	0.943	0.352
Sleep disturbances	1.23 ± 0.36	1.10 ± 0.32	1.207	0.235
Use of sleep medications	0.15 ± 0.05	0.13 ± 0.04	1.397	0.171
Daytime dysfunction	0.97 ± 0.28	1.12 ± 0.34	1.523	0.136

Data are presented as mean ± SD

t-independent sample *t*-test; *P*-value> 0.05was considered non-significant

Table 11 Comparison between group A and group B regarding Pittsburgh sleep questionnaire after 1 month postoperative

Pittsburgh sleep questionnaire after 1 month	Group A ($n=20$)	Group B ($n=20$)	*t*-test	*P*-value
Subjective sleep quality	0.86 ± 0.25	0.77 ± 0.23	1.185	0.243
Sleep latency	0.55 ± 0.16	0.53 ± 0.15	0.408	0.686
Sleep duration	0.32 ± 0.09	0.29 ± 0.08	1.114	0.272
Habitual sleep efficiency	1.05 ± 0.31	0.96 ± 0.28	0.964	0.341
Sleep disturbances	0.96 ± 0.28	0.87 ± 0.25	1.072	0.290
Use of sleep medications	0.10 ± 0.03	0.09 ± 0.03	1.054	0.299
Daytime dysfunction	0.91 ± 0.27	1.04 ± 0.31	1.414	0.165

Data are presented as mean ± SD

t-independent sample *t*-test; *P*-value> 0.05 was considered non-significant

ultrasound-guided axillary block group were significantly lower in the recovery room. At 24, 48, and 7 days, there were no significant variations in pain scores. Our findings are also consistent with those of Hadzic and Vloka (2004) who found that fewer patients (3%) who had infraclavicular block (INB) had a VAS score greater than 3 compared to (43%) who received GA (*P*-value 0.001).

Despite advances in anesthesia, postoperative nausea and vomiting remain common and troubling problems that cause patients distress and frequently delay discharge following ambulatory surgery. Our research found that patients in group B had a significantly lower risk of postoperative nausea and vomiting than patients in group A.

Our findings are consistent with those of Chan et al. (2001), who found that the GA group had the highest rate of nausea and vomiting requiring antiemetic medicine (62% vs 18% for IVRA and 12% for ABPB) (*P*-value 0.05). However, Liu et al. (2005) found no differences in PONV scores between the two groups (general anesthesia 0 0/2 and ultrasound-guided axillary block 0 median [range] at all time points *P*-value 0.06). In the general anesthetic group, just one patient required antiemetic rescue in the recovery room.

In comparison to patients in group A, our study found that patient satisfaction was significantly higher in group B.

However, Lee et al. (2014) discovered that there was no statistically significant difference in patient satisfaction levels between the two anesthetic procedures.

As a result of acute tissue damage, the surgical stress response causes metabolic and endocrine alterations, which leads to sympathetic activity activation, which increases alertness and wakefulness. In addition, postoperative discomfort causes sleep problems in the postoperative phase. In a study done by Ririn (2020) in the assessment of postoperative quality of sleep among mothers who delivered by cesarean section under spinal anesthesia, the so-called PSQI was employed to assess sleep quality in the postoperative period. And it was an effective score assessment.

According to the current study, there was a significant difference between groups A and B according to the Pittsburgh sleep questionnaire after 24 h and after the first and second week postoperative (*P*-value 0.05). However, there was no statistical difference between the two groups in the third week and 1 month after surgery. Our study agreed with the study of Desborough (2000) who revealed that regional anesthesia inhibits the stress response of surgery better than general anesthesia, resulting in better postoperative outcomes and sleep quality. However, a study by Jeong (2016) found no significant difference in sleeping quality regardless of the type of anesthesia given to laboring mothers in Korea (general or spinal). However, a study by Prakrithi et al. (2019) looked at factors that induce postoperative sleep disturbances using the PSQI and found that poor postoperative sleep quality was seen in all subgroups, regardless of the kind of anesthesia used.

Conclusions

When compared to general anesthesia, ultrasound-guided axillary brachial plexus block offered good anesthesia, great analgesia, and a better postoperative sleep result after hand surgery.

Abbreviations

ABPB: Axillary brachial plexus block; BPB : Brachial plexus block; DSU: Day surgery unit; GA: General anesthesia; H : Heart rate; MABP: Mean arterial blood pressure; NIBP: Non-invasive blood pressure; OSA: Obstructive sleep apnea; PACU: Post anesthesia care unit; PSQI: Pittsburgh Sleep Quality Index; REM: Rapid eye movement; SPO_2: Peripheral pulse oximetry; Sws: Slow wave sleep; VAS: Visual analog scale.

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Authors' contributions

ZM designed the study, revised the literature, followed the patients, and critically reviewed the manuscript. AA designed the study, analyzed the data, and wrote and critically revised the manuscript. MK and WM revised the literature and followed up the patients. MM collected the data, performed the analysis, and wrote the manuscript. All authors read and approved the final version of the manuscript.

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Availability of data and materials
The datasets generated and/or analyzed during the current study are not publicly available due (publishing the clinical data about any study conducted in our hospitals and approved by institutional ethical committee is against the policy of faculty of medicine, Ain Shams University, unless there is a reasonable request) but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was approved by ethical committee of the Ain Shams University with approval number FMASU M D 186/2019; the participants provided writing consent. This study was retrospectively registered at ClinicalTrials.gov (NCT04727515), registered on January 2021.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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References

Aloba OO, Adewuya AO, Ola BA (2007) Validity of the Pittsburgh Sleep Quality Index (PSQI) among Nigerian university students. Sleep Med 8:266–270
Bernards CM, Hadzic A, Suresh S, Neal JM (2008) Regional anesthesia in anesthestized or heavily sedated patients. Reg Anesth Pain Med 33:449–460
Besedovsky L, Lange T, Born J (2012) Sleep and immune function. Pflugers Arch 463:121-37.
Bird SB, Dickson EW (2001) Clinically significant changes in pain along the visual analog scale. Ann Emerg Med 38:639–643. https://doi.org/10.1067/mem.2001.118012
Chan VW, Peng PW, Kaszas Z, Middleton WJ, Muni R, Anastakis DG et al (2001) A comparative study of general anesthesia, intravenous regional anesthesia, and axillary block for outpatient hand surgery: clinical outcome and cost analysis. Anesth Anal 93(5):1181–1184
Chung F, Liao P, Elsaid H (2014) Factors associated with postoperative exacerbation of sleep-disordered breathing. Anesthesiology. 120:299–311
Coluzzi F, Bragazzi L, Di Bussolo E, Pizza G, Mattia C (2011) Determinants of patient satisfaction in postoperative pain management following hand ambulatory day-surgery. Minerva Med 102:177–186
Desborough JP (2000) The stress response to trauma and surgery. Br J Anaesth 85:109–117
Finan PH, Goodin BR, Smith MT (2013) The association of sleep and pain: an update and a path forward. J Pain 14:1539–1552
Hadzic A, Vloka DJ (2004) In: Hadzic A, Vloka DJ (eds) Keys to success for peripheral nerve blocks, peripheral nerve blocks: principles and practice. McGraw-Hill, New York, pp 79–78
Heiberger RM, Robbins NB (2014) "Design of Diverging Stacked Bar Charts for Likert Scales and Other Applications". Journal of Statistical Software. American Statistical Association. pp. 1–32. http://www.jstatsoft.org/v57/i05
Horner RL, Peever JH (2017) Brain circuitry controlling sleep and wakefulness. Continuum. 23:955–972. https://doi.org/10.1212/CON.0000000000004495.1
Jeong HL (2016) Difference in effects on sleep quality and stress depending on anesthetic methods in women who underwent cesarean section in Korea. RMJ. 41(4):471–475
Lee MG, Kim HS, Lee DC, Jung WS, Chang YJ (2014) A comparison of general anesthesia versus axillary brachial plexus block for hand and wrist surgery in the view of patient satisfaction. Anesth Pain Med 9(1):19–23
Li S, Coloma M, White PF (2000) Comparison of the costs and recovery profiles of three anesthetic techniques for ambulatory anorectal surgery. Anesthesiology. 93:1225–1230
Liu SS, Strodbeck WM, Richman JM, Wu CL (2005) A comparison of regional versus general anesthesia for ambulatory anesthesia: a metaanalysis of randomized controlled trials. Anesthesia & Analgesia 101(6):1634-1642.
Malinzak EB (2009) Tong J Gan Publication date 2009/9/1 Source Anesthesia & Analgesia 109(3):976-980.
O'Donnell BD, Ryan H, O'Sullivan O, Iohom G (2009) Ultrasound-guided axillary brachial plexus block with 20 milliliters local anesthetic mixture versus general anesthesia for upper limb trauma surgery: an observer-blinded, prospective, randomized, controlled trial. Anesth Anal 109(1):279–283
Poulsen RC, Warman GR, Sleigh J, Ludin NM, Cheeseman JF (2018) How does general anaesthesia affect the circadian clock? Sleep Med Rev 37:35–44. https://doi.org/10.1016/j.smrv.2016.12.002
Prakrithi SN, Chandran S, Rao M, Kishor & Pradeep, TS. (2019) A comparative study of the quality of sleep in patients in the ward: Pre and postsurgery in a tertiary care hospital in South India. Muller J Med Sci Res 10:1. https://doi.org/10.4103/mjmsr.mjmsr_37_18
Ririn, Harini Juwitasari Publication Articles Oktober-Desem… Post-caesarean section pain and qu… 3473-12445-1-PB.pdf 456.17 K 7 3, 628 19, 903 23-Dec-2020 08: 11 PM (UTC + 0700) 1480857366.
Song D, Greilich NB, White PF (2009) Recovery profiles and costs of anesthesia for outpatient unilateral inguinal herniorrhaphy. Anesth Analg 91:876–881
Urmey W (2006) Pulmonary complications. In: Neal JM, Rathmell J (eds) Complications in regional anesthesia and pain medicine. Philadelphia, Saunders Elsevier, pp 147–156
Vincent WSC, Philip WHP, Zsuzsanna K, William JM, Rajeev M, Dimitri GA, et al (2001) Departments of Anesthesia and Surgery, University of Toronto, The Toronto Western Hospital, University Health Network, Toronto, Ontario, Canada.

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