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Costoclavicular brachial plexus block in paediatric anaesthesia: A retrospective pilot study

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The costoclavicular brachial plexus block (CCBPB) is a recently described ultrasound-guided block [1] that targets the chords of the brachial plexus in the costoclavicular space (CCS), where they are arranged superficially in a bundle. Experience in children is limited to case reports [2], hence data about safety and applications are lacking. Our goals were to determine the complication rate and identify the clinical applications of CCBPB in children.

This is a single-center retrospective study conducted in a paediatric hospital in Portugal. We analysed a three-year period (January 2017 to December 2019) with data extracted from a regional anaesthesia database in which patients cannot be identified. Therefore, according to institution protocol, IRB approval was not required. Data are expressed as means (standard deviation; range) for numeric variables and as counts and percentages for categorical variables. Binomial distribution was used to estimate the 95% confidence interval (CI) for complications.

Overall, 484 upper limb blocks were performed, of which the majority were CCBPB (n = 200; 41.3%). All blocks were placed under general anaesthesia. Table 1 shows the type of block performed detailed by year. A clear change in practice is noted throughout the years and, in 2019, CCBPB was preferred in 67.9% of cases.

A total of 200 CCBPB were performed in 198 patients. The mean age was 9.07 ± 4.09 years. Weight ranged from 11 to 97 kg and most patients (73.23%) were classified as ASA I. Overall, 98% of CCBPB were unilateral and single shot blocks. Four catheters were placed and were infused for a mean of 2.5 days, with no malfunctions reported. See Table 2 for patient demographics and specifics related to CCBPB placement.

Table 1
Brachial plexus block approaches performed by year.

Site	2017	2018	2019	Total (%)
Interscalene	1	1	2	4 (0.8%)
Supraclavicular	69	22	6	97 (20%)
Infraclavicular	22	41	29	92 (19%)
Costoclavicular	17	77	106	200 (41.3%)
Axillary	43	19	5	67 (13.8%)
Distal	13	3	8	24 (5.1%)
Total	**165**	**163**	**156**	**484**

CCBPB were performed for orthopaedic, plastic, and paediatric surgery of the upper limb. Most patients received CCBPB for elbow (48.5%) and forearm (29%) surgery. The most prevalent diagnosis were bone fractures (n = 160; 80%) and soft tissue trauma (n = 21; 10.5%). The most prevalent surgeries were osteosynthesis of supracondylar (n = 58; 29%) and radius and/or ulnar shaft fractures (n = 50; 25%).

CCBPB provides surgical anaesthesia for upper limb below the shoulder since the brachial plexus is approached at the cords before the emergence of the medial brachial and antebrachial cutaneous nerves. The consistent topographical arrangement in the CCS allows easy and safe access to the brachial plexus, with a low block failure rate. A success rate of 97% was reported [3] for surgical anaesthesia in adults, as well as rapid onset of sensory and motor blockade of the major nerves of the brachial plexus. These characteristics make the CCBPB an unchallenging block with a short learning curve.

The CCS is also an optimal location for catheter placement, as the catheter tip is placed close to the three cords, and through the subclavius and pectoralis major muscles, reducing the risk of catheter dislodgment.

The incidence of complications was 1:200 (0.5%) with a 95% CI of 0–1.5%. An axillary artery puncture in a 2-year-old, 15 kg, ASA II toddler, was reported in this approach. No haematoma or permanent sequelae were reported. Other site-specific complications such as pleural puncture and phrenic nerve paralysis are lower in CCBPB since the parietal pleura is deeper than neurovascular structures, and the compact topography allows reducing the local anaesthetic volume used.

This study is limited by its retrospective single-center design and small size. Prospective clinical studies with larger populations are needed to validate our findings.

We demonstrate the use of CCBPB in bone and soft tissue surgery of the arm, elbow, forearm, and hand with a low complication rate in paediatric patients, which should encourage its widespread use. In conclusion, CCBPB can be used safely in children for upper arm surgery.

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Table 2
Patient demographics, surgical procedures and CCBPB characteristics.

Patient demographics	**n = 198**	
Sex	**n**	**%**
Male	131	66.2%
Female	67	33.8%
Age at surgery, years	9.07 (SD ± 4.09)	
Range	1 year – 20 years	
Weight, kg	33.13 (SD ± 15.97)	
Range, kg	11–97	
ASA	**n**	**%**
I	145	73.23%
II	48	24.24%
III	5	2.53%

Surgical location and most common procedures	**n = 200**	**%**
Arm	13	6.5%
Humeral osteosynthesis	6	3%
Humeral osteotomy	5	2.5%
Other humeral surgeries	2	1%
Elbow	97	48.5%
Osteosynthesis of supracondylar fractures	58	29%
Osteosynthesis of other distal humeral fractures	20	10%
Osteosynthesis of radial head and/or olecranon fractures	18	9%
Abscess drainage	1	0.5%
Forearm	58	29%
Osteosynthesis of radius and/or ulnar shaft fractures	50	25%
Radius osteotomy	3	1.5%
Soft tissue surgery	3	1.5%
Osteosynthesis material extraction	2	1%
Hand and wrist	32	16%
Osteosynthesis of distal radius and/or ulnar fractures	5	2.5%
Osteosynthesis of hand bone fractures	6	3%
Osteotomies of distal radius, ulna, or hand bones	4	2%
Soft tissue surgery	17	8.5%

CCBPB characteristics	**n = 200**	**%**
Laterality		
Unilateral	196	98%
Bilateral	4	2%
Catheter placement		
Single shot	196	98%
Catheter placed	4	2%
Type of local anaesthetic		
Ropivacaine	145	72.5%
0.5%	6	3%
0.375%	93	46.5%
0.2%	44	22%
0.15%	1	0.5%
0.1%	1	0.5%
Levobupivacaine	55	27.5%
0.5%	3	1.5%
0.25%	49	24.5%
0.125%	3	1.5%
Adjuvant	n = 198	
I.V. dexamethasone (0.1 mg/kg)	115	58.1%

Disclosures

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Filipa Carioca, (MM)[a,*,1], Marisa Silva, (MM)[a,1], Catarina Bispo, (MM)[a,1], José Mafra, (MD)[b], Teresa Cenicante, (MD)[b]

[a] *Anaesthesiology Resident, Dona Estefânia Children's Hospital, University Medical Centre of Central Lisbon, Portugal*

[b] *Senior Graduated Anaesthesiologist, Dona Estefânia Children's Hospital, University Medical Centre of Central Lisbon, Portugal*

[*] Corresponding author at: Serviço de Anestesiologia, Hospital Dona Estefânia, Rua Jacinta Marto, 1169-045 Lisboa, Portugal.
E-mail address: filipacarioca@campus.ul.pt (F. Carioca).

[1] These authors contributed equally to the manuscript.