Axillary Block and Sedation for Cardiac Catheterization

G. W. N. Eggers, Jr., M.D.,* M. T. Metzgar, M.D.,†
J. E. Plummer, M.D.‡

The desirability of producing a passive state in children to facilitate cardiac catheterization has been repeatedly emphasized.¹–¹⁷ Methods employed have varied but essentially fall into two categories; inhalation anesthesia or basal sedation. All sought to produce a quiescent, cooperative unfrighted infant or child with minimal physiological alteration, particularly of ventilation and circulation. Since light levels of anesthesia or sedation satisfied the desired requirements, only the painful aspects of the procedure (cut-down or needle insertions) needed added consideration. Analgesia was provided by the use of local anesthetics in most instances. Known has pointed out the usefulness of regional anesthetics combined with sedation in pediatric orthopedic patients and the same principles apply during cardiac catheterization. By combining an axillary block with psychic sedation, we believe a useful clinical technique has been developed.

**METHOD**

**Patient Groups.** Twenty-three children whose average weight was 16.2 kg. (range 7.7–38.2) and average age was slightly above four years were included in this study. Two patients were below one year of age and three above five years of age. Four of the children were of Physical Status Class 1, six-teen of Class 2 and the remainder of Class 3 (A.S.A. Classification). Two had repeat catheterizations so that a total of twenty-five procedures were involved. Oral intake was regulated as previously described.³

**Premedication.** Each patient received both meperidine (0.45 mg. per kg. or 1 mg. per lb.) and pentobarbital (Nembutal) (0.45 mg. per kg.) intramuscularly 60 minutes prior to the scheduled catheterization time. Belladonna drugs used included scopolamine (0.1 or 0.2 mg.) for thirteen patients or atropine (0.1 or 0.2 mg.) for seven. Five children received no belladonna derivatives. Total dosage of each premedicant was appropriately decreased in the more severely ill patients.

**Sedation.** At the time of catheterization, additional sedation was provided by the rectal administration of methohexital 10 per cent (Brevital) or, in two patients, thiopental 10 per cent (Pentothal) in a dosage of 4.5 mg. per kg. (10 mg. per lb.). Five children were given thiopental 5 per cent intramuscularly (3.5–4.5 mg. per kg.). Two patients did not require further sedation other than their premedication.

**Regional Anesthesia.** An axillary block utilizing lidocaine (Xylocaine), 1 or 1–1½ per cent, was performed on the arm chosen for catheter insertion. Epinephrine (1:200,000) was used in all but four instances. Average dosage injected was 1.4 mg. per kg. (range 0.77–1.9) as has been recommended.¹⁹ Axillary block was performed with a 25 gauge short needle after the patient became drowsy although still cooperative.¹⁹ One patient had a supraclavicular perivascular block as described by Winnie and Collins.²²

---

* Professor of Anesthesiology, Department of Anesthesiology, University of Missouri School of Medicine.
† Assistant Professor of Anesthesiology, Department of Anesthesiology, University of Missouri School of Medicine.
‡ Assistant Professor of Anesthesiology, Department of Anesthesiology, University of Missouri School of Medicine.
Maintenance. No further agents were needed in most instances, but five patients were given additional sedation (either intramuscularly or rectally) as required by their activity. Since the axillary block prevented movement of the arm, no interference with the procedure occurred. If the volume of blood removed for sampling was excessive, it was replaced with typed and cross matched blood at the end of the procedure.

Results

Satisfactory diagnostic studies were completed in all but three instances which failed or were incomplete because of technical problems related to catheterization. No procedures were cancelled because of excessive depression due to preanesthetic medication. Premedication was inadequate in two patients (both of whom were behavioral problems) and had worn off in one (due to a delay in starting). The average duration of catheterization was 81 minutes (range 45–105). Fourteen patients were taken to the Post-Anesthesia Recovery Room after the procedure, where their average stay was 2½ hours (range 1½ to 5 hours).

One patient (3 years old, mongoloid, female, 13.2 kg.) developed apnea following rectal methohexital (4.5 mg. per kg.) and axillary block with lidocaine 1 per cent (1.8 mg. per kg.). There was also evidence of diminished cardiac output detected by muffled heart sounds and a less palpable pulse. The patient was intubated and artificial ventilation with oxygen instituted and maintained throughout the remainder of the procedure. No epinephrine had been added to the anesthetic solution, a factor which may have predisposed to a systemic reaction to the lidocaine. The quantity of drug was considered a relative rather than absolute overdose. Since the patient improved rapidly, it was elected to continue with and complete the catheterization.

Oropharyngeal airways were not found necessary. There was evidence, in arterial blood samples from eight patients, that ventilation was not greatly impaired (table 1). The remaining patients were clinically well oxygenated except for those with a right-to-left shunt.

| Table 1. Systemic Arterialized* Blood Oxygen Saturation |
|-----------------|-----------------|-----------------|
| Without Right-to-Left Shunt | With Right-to-Left Shunt |
| Number of patients | 8 | 3 |
| Saturation (%) | 96.6 (91.2–98.5) | 82.2 (68.2–91.4) |

* Samples from left ventricle, aorta or systemic arteries; patients breathing room air.
† Range.

Discussion

The addition of an axillary block to facilitate cardiac catheterization provided four advantages: (1) Anesthesia for cut-down and/or needle insertion in the arm. (2) The child was unable to move the anesthetized arm during the procedure. (3) Some added sedation from mild systemic effects of lidocaine probably occurred and could have been an advantage in maintaining the passive state. (4) Although not subject to objective determination, it was our impression that there was less spasm of the veins (as anticipated). The ease of performance of the block and the comfort to the child were gratifying to all participating.

The potential hazard of adverse systemic effects from lidocaine is inherent in this method. However, awareness of the possibility of regional agent reaction, careful technique and attentive management should place the danger to the patient on a par with or less than other reported methods. Interestingly enough, in reviewing the literature, Ingalls mentioned the use of brachial plexus block with rectal tribromethanol in 1954, which he discarded for rectal thiopental plus intravenous meperidine. It was assumed that the brachial plexus block technique used was the supraclavicular method of Kulenkampff which is potentially more hazardous than the axillary block. Prolonged awakening was a distinct disadvantage of our method when compared with general anesthesia. However, this was no more extensive than with other techniques utilizing sedation and with good recovery room facilities, this disadvantage is less problematic. The hope that rectal methohexital would reduce prolonged awakening was not
confirmed. Perhaps this was a result of the use of heavier premedication in our patients. We were pleased to observe that preliminary cleansing enemas were not needed as emphasized by Budd and his co-authors. The duration of our procedures was somewhat shorter than reported by many others, perhaps due to recent improvement in catheterization techniques. A major disadvantage in the use of an axillary block was the choice or need to insert a catheter or needle into a vessel in the groin (e.g., children under 15 pounds). Under those indicated circumstances, local anesthesia was injected intradermally and the technique was virtually the same as previous reports.

The authors acknowledge the help and cooperation of H. G. E. Stoeckle, Jr., M.D., Associate Professor of Pediatrics, Department of Pediatrics, University of Missouri School of Medicine.

REFERENCES