

# Intra-articular analgesia following arthroscopic surgery of the shoulder

F. RODOLÀ, S. VAGNONI, S. D'AVOLIO, M. VURCHIO, D. MICCI, A. CHERICHINI, A. VERGARI, F. CIANO

Istituto di Anestesiologia e Rianimazione, Catholic University of Sacred Heart - Rome (Italy)

**Abstract.** – Shoulder surgery is very often followed by severe postoperative pain. Loco-regional anaesthesia has greatly contributed as a solution of this problem.

Nevertheless most of surgery is still performed under general anaesthesia.

In this case many different methods have been proposed in order to mitigate postoperative pain.

Intra-articular administration of local anaesthetics after shoulder surgery is not yet in routinely clinical practice.

In this study efficacy of intra-articular administration of Ropivacaine versus Bupivacaine has been evaluated.

Analysis of results showed both drugs to share the same effectiveness within four hours postoperatively. In subsequent period (6-24 hours) Ropivacaine demonstrated to provide a statistically significant better postoperative pain relief.

Furthermore Ropivacaine group patients needed postoperative analgesics to a lesser extent than Bupivacaine group.

The long-lasting satisfactory level of analgesia, particularly with Ropivacaine, could recommend the use of intra-articular analgesia even for day-hospital or one-day surgery procedures.

*Key Words:*

*Postoperative analgesia, Shoulder surgery, Arthroscopy.*

## Introduction

Pain following shoulder surgery (both arthroscopic or not) often represents a difficult challenge to deal with.

Locoregional anaesthesia, mainly interscalenic approach to brachial plexus block, represents a good answer to the problem<sup>1</sup> because is often sufficient to decrease the need

for intramuscular (i.m.) or intravenous (e.v.) narcotics (analgesics) postoperatively.

Nevertheless many surgical procedures on the shoulder are still performed under general anaesthesia for some of the following reasons:

1. Patient's refusal or specific contraindications (e.g.coagulopathies);
2. Insufficient anaesthesiological skill in this technique;
3. Partial or total failure of the technique.

Many methods have been proposed for postoperative pain relief, besides e.v. or i.m. administration of NSAIDs and-or narcotics; among others continuous epidural cervical blockade<sup>2</sup>, local anaesthetic irrigation of surgical field via an epidural catheter<sup>3</sup> or a drainage tube<sup>4</sup>.

Direct administration of local anaesthetic, however, is still not currently used for shoulder surgery<sup>6-7</sup>, despite its large use for arthroscopic knee surgery<sup>5</sup>.

Introduction of ropivacaine, a long-active amidic local anaesthetic<sup>8</sup>, in clinical practice has greatly improved postoperative pain relief for it combines long-lasting analgesia with lower toxicity, in comparison to bupivacaine.

Aim of this study is to evaluate efficacy of ropivacaine versus bupivacaine for postoperative pain treatment after arthroscopic shoulder surgery.

## Materials and Methods

70 patients (m/f: 41/29) aged between 23-75 years (in average 34 ys ± 21) scheduled to undergo arthroscopic surgery of the shoulder

Table I. Demographic data of patients and average duration of the arthroscopic procedures (mean  $\pm$  SD).

|  | Group 1         | Group 2       |
|--|-----------------|---------------|
| Sex (M/F)  | 19/16           | 15/20         |
| Age (years $\pm$ SD)   | 40,1 $\pm$ 11,5 | 36,9 $\pm$ 13 |
| Weight (kg $\pm$ SD)   | 71,2 $\pm$ 8,4  | 73 $\pm$ 6,6  |
| Average duration of the arthroscopic procedures (min $\pm$ SD) | 53 $\pm$ 22,2   | 58 $\pm$ 20,9 |

under general anaesthesia were included in this study. Exclusion criteria included documented or presumed allergic reaction to local anaesthetics and the positioning of an intra-articular drainage tube at the end of surgery. The study was approved by the institutional review board and involved written informed consent.

Diazepam (0,2 mg  $\times$  kg<sup>-1</sup>) and atropine (0,01 mg  $\times$  kg<sup>-1</sup>) were given as premedication; induction of anaesthesia has been obtained with thiopentone (2-4 mg  $\times$  kg<sup>-1</sup>). Sevoflurane 1-2% in O<sub>2</sub>/N<sub>2</sub>O (FiO<sub>2</sub> = 0,5) inhalational mixture has been used for maintenance. E.v. fentanyl administration was titrated according to clinical needs.

Vecuronium bromide (0,08 mg  $\times$  kg<sup>-1</sup>) was used as muscle relaxant.

An e.v. mixture of neostigmine bromide (0,07 mg  $\times$  kg<sup>-1</sup>) and atropine (0,03 mg  $\times$  kg<sup>-1</sup>) has been administered at the end of surgery to reverse neuromuscular block.

Intraoperatively 5 leads EKG, non-invasive blood pressure, transcutaneous oximetry and end-Tidal CO<sub>2</sub> were continuously recorded throughout the surgery.

Patients were randomly assigned to one of two groups and single blinded data were collected. Just before the end of surgery, in group 1 patients (n = 35) 20 ml of 0.5% bupivacaine were administered intra-articularly through the surgical port, while group 2 (n = 35) received 20 ml of 0,75% ropivacaine.

Postoperative pain was evaluated at 1, 2, 3, 4, 6, 12, 24 hours after the end of surgery with Visual Analogic Score (VAS) in a 1 to 10 scale. Request for analgesics was recorded as well. In Table I demographic the patients' data and the average time required for arthroscopic procedures in both groups are reported. Statistical analysis of VAS and e.v. boluses of analgesics in both groups was performed using Student's Test.  $P < 0.05$  was considered significant.

## Results

Demographic data of the patients, duration of surgery and Fentanyl requirements were similar in both groups.

Comparison of VAS (Table I) showed no statistical difference between the two groups in the first to fourth hour period. Both local anaesthetics have proved to have the same efficacy (VAS  $<$  3).

6 hours after the end of surgery group 1 (bupivacaine) showed VAS statistically higher (VAS  $>$  5) ( $P < 0.05$ ) when compared to group 2 (ropivacaine).

No significant statistical differences were detectable after 12 and 24 hours of observation ( $P > 0.05$ ) even though patients in group 2 had a lower VAS level.

20 patients in group 1 (Bupivacaine) needed analgesics in the observation period up to a total of 29 administrations; while in group 2 (Ropivacaine) 7 patients needed analgesics up to a total of 9 administrations ( $P < 0.05$ ).

## Discussion

Wound infiltration with local anaesthetic, close to peripheral nerves, or next to the site of insurgence of noxious stimuli is not a common practice, though in several studies it has been demonstrated as an highly effective analgesic technique<sup>9-12</sup>.

Table II. Request for supplementary analgesia.

|         | # of patients | (*) # of patients |
|---------|---------------|-------------------|
| Group 1 | 20            | 29                |
| Group 2 | 7             | 9                 |

(\*)  $p < 0.05$ .

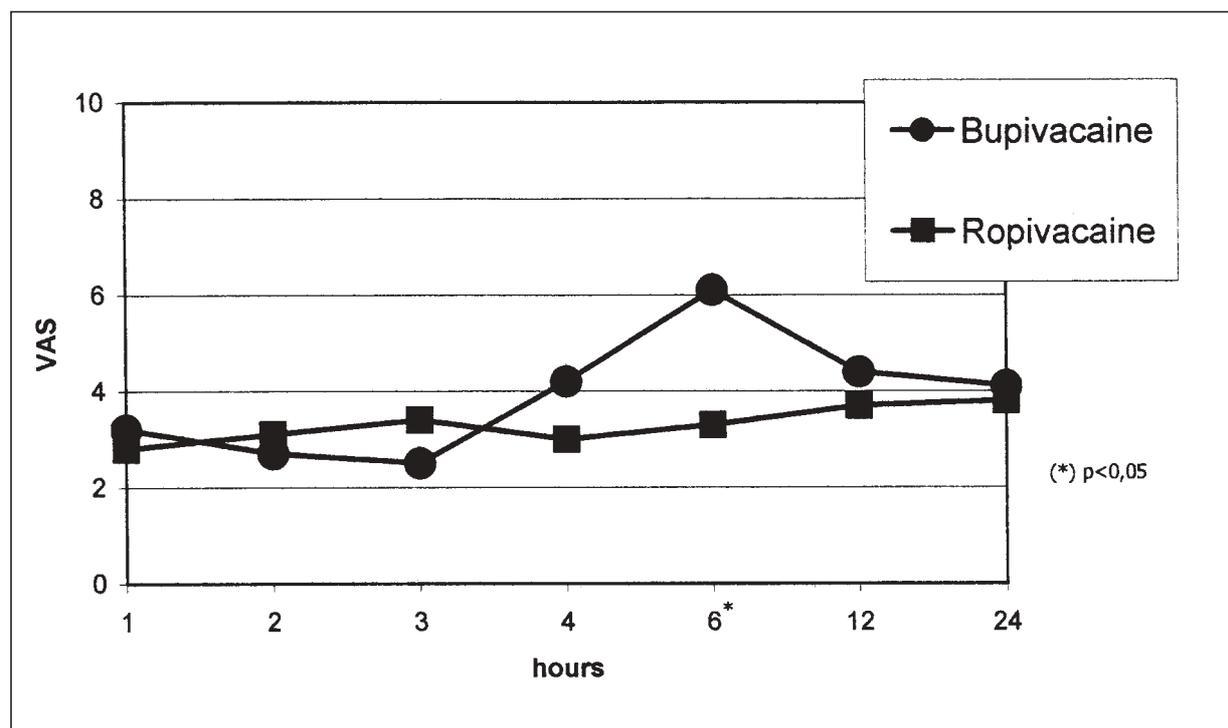


Figure 1. VAS in the postoperative period.

Local anaesthetic could modulate pain transmission at the peripheral level by inhibiting the transmission of nociceptive impulse from the site of injury.

Another mechanism for intra-articular analgesia is suggested by observations showing decreased binding of substance P in tissue culture cells preincubated with local anaesthetics<sup>13</sup>; for a better effectiveness of the technique local anaesthetic administration should start as soon as possible, at least by the end of surgical procedure. In our study intra-articular Ropivacaine proved to be effective in reducing both patient's discomfort and need for analgesics. Fading of analgesic effect of Bupivacaine after about 6 hours is consistent with its pharmacological properties. This technique has proved to be safe, easy to perform and inexpensive.

At described doses, plasmatic concentration of both drugs remain far below toxic threshold<sup>14,15</sup>. Available data about risks of infection cannot support this concern. Moreover a bacteriostatic and antimicrobial effect of local anaesthetic drugs has been demonstrated<sup>16-17</sup>.

In conclusion the long lasting satisfactory analgesia, mainly after Ropivacaine adminis-

tration, seems to make this technique available even for day-hospital or one day-surgery procedure (for this procedures PCA has been proposed as well)<sup>18</sup>. The usefulness of the above techniques following general anaesthesia for postoperative pain management is out of question. It would be of interest a evolution with multipharmacologic approach to intra-articular analgesia in order to control not only postoperative pain but also inflammatory response, because of the role they may play in enhancing convalescence and functional recovery<sup>19</sup>.

#### References

- 1) WINNIE AP. Interscalene brachial plexus block. *Anesth Analg* 1970; 49: 455-466.
- 2) NERUDA B, KIESER H. Erfahrungen mit der kontinuierlichen cervikalen periduralanalgesie bei operationen in schulterbereich. *Anaesthetist* 1989; 38 (Suppl 1): 113.
- 3) CASTRO WHM, JEROSCH J, JENSEN KU, GOERTZEN M, HILLE E. Continuous subacromial perfusion of local anesthetics after arthroscopic subacromial surgery (Abstr) *Arthroskopie* 1990; 3: 81-83.

- 4) NERUDA B, LU H, RUTHER W. Pain therapy for operations on the shoulder by using local flooding of surgical field with bupivacaine. A preliminary report. *Minerva Anesthesiol* 1996; 62 (Suppl 1 n 4): 314.
- 5) MOINICHE S, MIKKELSEN S, WETTERSLEV J, BERG DAHL J. A systematic review of intra-articular local anesthesia for postoperative pain relief after arthroscopic knee surgery. *Reg Anesth and Pain Med* 1999; 24: 430-437.
- 6) MUITTARI PA, NELIMARKKA O, SEPPALA T, KANTO JH, KIRVELA OA. Comparison of the analgesic effects of intrabursal oxycodone and bupivacaine after acromioplasty. *J Clin Anesth* 1999; 11: 11-16.
- 7) TETZLAFF JE, BREMS J, DILGER J. Intraarticular morphine and bupivacaine reduces postoperative pain after rotator cuff repair. *Reg Anesth Pain Med* 2000; 25: 611-614.
- 8) MC CLURE IH. Ropivacaine. *Br J Anaesthesia* 1996; 76 : 300-307.
- 9) OWEN H, GALLOWAY DJ, MITCHELL KG. Analgesia by wound infiltration after surgical excision of benign breast lumps. *Ann R Coll Surg Engl* 1985; 67: 114-115.
- 10) CHESTER JF, RAVINDRANATH K, WHITE BD, et al. Wound perfusion with bupivacaine: objective evidence for efficacy in postoperative pain relief. *Ann R Coll Surg Engl* 1989; 71: 394-396.
- 11) TROTTER TN, HAYES-GREGSON B, ROBINSON S, et al. Wound infiltration of local anesthetic after lower segment cesarean section. *Anaesthesia* 1991; 46: 404-407.
- 12) BAYS RA, BARRY L, VASILENKO P. The use of bupivacaine in elective inguinal herniorrhaphy as a fast and save technique for relief of postoperative pain. *Surg Gyn Obst* 1991; 173 : 433-437.
- 13) LI YM, WINGROVE DE, TOO HP, et al. Local anesthetics inhibit substance P binding and evoked increases in intracellular Ca<sup>++</sup>. *Anesthesiology* 1995; 82: 166-173.
- 14) MEINIG RP, HOLTGREWE JL, WIEDEL JD, CHRISTIE DB, KESTIN KG. Plasma bupivacaine levels following single dose intraarticular instillation for arthroscopy. *Am J Sports Med* 1988; 16: 295-300.
- 15) ASTRA. Report 1994; 802-550-LC-0100-01.
- 16) ROSENBERG PH, RENKONEN OV. Antimicrobial activity of bupivacaine and morphine. *Anesthesiology* 1985; 62: 178-179.
- 17) SAKURAGI T, ISHINO H, DAN K. Bactericidal activity of clinically used local anesthetics on *Staphylococcus aureus*. *Reg Anesth* 1996; 21: 239-242.
- 18) RAWAL N, AXELSSON K, HYLANDER J, ALLVIN R, AMILON A, LIDERGRAN G, HALLEN J. Postoperative patient-controlled local anesthetic administration at home. *Anesth Analg* 1998; 86: 86-89.
- 19) RASMUSSEN S, LARSEN AS, THOMSEN ST, KEHLET H. Intra-articular glucocorticoid, bupivacaine and morphine reduces pain, inflammatory response and convalescence after arthroscopic meniscectomy. *Pain* 1998; 78: 131-134.