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B.Minchev, D.Markov, D.Maximov, T.Zachariev, G.Tzarianski, Al.Tschirkov COPD PATIENTS UNDERGOING ELECTIVE TRANSPERITONEAL ABDOMINAL AORTIC REPAIR: ADVANTAGES OF EPIDURAL ANALGESIA. A SEVEN-YEAR EXPERIENCE

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Summary: Introduction: The purpose of this study was to examine the advantages of epidural analgesia in patients with chronic obstructive pulmonary disease (COPD), underwent elective transperitoneal aneurysmorrhaphy. These patients are more likely to develop pulmonary morbidity following major abdominal surgery.

Methods: During a 7-year period all patients who have been diagnosed with COPD undergoing elective abdominal aortic aneurysm (AAA) repair (n=119) in "St. Ekaterina" hospital are reviewed. Inclusion criteria were an FEV1/FVC ratio <75% and/or PaCO₂ >45mmHg. Clinical outcomes were compared between those who received epidural analgesia (epidural group) and those patients in whom pain management was via patient controlled analgesia (PCA) or intravenous opioids (control group). Primary endpoints measured were pulmonary complications, duration of intubation, ICU stay, and hospital days.

Results: Strict inclusion criteria were met by 119 patients. We divided patients into two groups - 78 patients in the epidural group and 41 patients in the control group. When comparing the epidural vs. control group the mean AAA size was 6.5 0.8cm vs. 6.2 1.5cm, FEV1 was 57.5 23.8% vs. 49.8 11.6%, and the mean FEV1/FVC ratio was 53.0 11.6% vs. 50.9 5.8%, respectively. The overall hospital stay remained similar between the two groups. The epidural group had a significantly lower incidence of postoperative ventilator dependency and ICU stay (p<0.05), as well as a decreased bend for pulmonary complications when compared to the control group. The relative risk of developing a pulmonary complication in the absence of epidural analgesia was 2.3.

Conclusions: Epidural analgesia should be considered in all COPD patients undergoing elective transperitoneal AAA repair. It is a beneficial in patients with COPD undergoing AAA repair by reducing both the postoperative ventilator duration and ICU stay.

Keywords: abdominal aortic aneurysm, chronic pulmonary obstructive disease, epidural analgesia.

Methods

Patient selection. From January 1996 to October 2002, all patients diagnosed with COPD and AAA, and underwent elective transperitoneal AAA repair in our hospital were retrospectively reviewed. Only the patients in whom a diagnosis of COPD could be supported either a history of bronchitis or evidence of emphysema by chest radiograph and pulmonary function tests (PFTs) were included in this study. Forced expiratory volume (FEV1) in 1 sec of 50% of the predicted value and forced vital capacity (FVC) of 75% of predicted value have been shown to be indicative of severe pulmonary dysfunction [10]. Therefore we considered patients with FEV1: FVC ratio less than 75% of predicted value or a PaCO₂ greater than 45 mmHg to be at an increased risk for pulmonary complications following open AAA repair and thus, included in this study. Although cigarette smoking is the single most important risk factor for developing COPD, only 15% of chronic smokers will actually acquire medically significant obstructive airway disease. For this reason we felt it imperative to have objective documentation of the existence of COPD in those patients included in this study. Conse-

quently, patients presumed to have airway disease from chronic tobacco use, but had no formal pulmonary testing were excluded from review. FEV1 was documented in order to classify the severity of COPD. Furthermore, patients with either ruptured AAA or use a suprarenal crossclamp were excluded from this study.

Perioperative management. All patients with COPD referred for elective AAA repair at our hospital underwent routine evaluation by cardiologists and pulmonologists. Patients were further evaluated on an individual basis with formal PFTs and arterial blood gas analysis. Patients with severe COPD (FEV1,1.5L/sec) received bronchodilator therapy in the perioperative period and occasionally intravenous steroids; either treatment was strictly at the discretion of the attending anesthesiologist. Smoking cessation was recommended for the 8 weeks preceding the operation. Despite our recommendation, however most patients were unable to adhere to this guideline. Prior to surgery, patients were instructed in the use of incentive spirometry. Postoperative care of all AAA repair patients was in accordance with a standardized clinical pathway followed at our institution.

Epidural analgesia. Anesthesiologist placed epidural catheters in either the immediate preoperative period or in the recovery room following surgery. The level of epidural catheter insertion was the Th9-10 interspace. The analgesic agents administered included hydromorphone, bupivacaine, and meperidine. General anesthesia was used throughout the operations in either group with loading of the epidural performed at the completion of the procedure or in the recovery room. Epidural analgesics were discontinued upon return of gastrointestinal function at which time the patient was able to tolerate oral analgesics. In the control group, patients who had a PCA (patient controlled anesthesia) device had the appliance discontinued when alimentation was resumed.

Study endpoints. Medical records were analyzed for determination of length of postoperative mechanical ventilation, number of days in the intensive care unit (ICU) and hospital, and pulmonary complications, such as pneumonia, prolonged ICU stay, and respiratory failure requiring intubation.

Results

119 patients with AAA and COPD, undergoing transperitoneal AAA repair met the strict inclusion criteria for this study during the time frame specified as defined by the PFT parameters. The study group included those who received postoperative pain management with epidural analgesics (n=78) and the control group was comprised of patients whose pain management was treated with either PCA or other methods of delivering intravenous opioids (n=41). There were two cases of 30-day postoperative mortality in each group (2.56% in epidural and 4.87% in controlled group). Demographics of the two groups are present in Table 1. Postoperative pulmonary complications between the two groups were summarized in Table 2. All patients receiving epidural anesthesia had similar doses of systemic narcotics compared to the control group. The duration or dosages of perioperative steroids were similar between groups. No significant differences in age, tobacco use as measured in

pack-years, aneurysm size, or FEV₁:FVC ratio. Table 3 illustrates a comparison of various endpoints between the two groups. Duration of postoperative mechanical ventilation and length of ICU stay were significantly shorter in the patients receiving epidural analgesia (n<0.05). There was a trend towards shorter hospitalizations following AAA repair in the epidural group, although it was not statistically significant. Similarly there was no decreased trend in pulmonary complications in the epidural group (21% vs.46% in epidural vs. control group, n=0.05). There was no difference in the amount of time for return of gastrointestinal function (epidural 3.8 ± 0.7 days, control 4.0 ± 1.2 days; p = NS). The overall hospital stay was similar between the two groups. The relative risk of developing pulmonary complications following elective AAA repair in the absence of epidural analgesia was 2.2.

Table 1

Patient demographics

Characteristics	epidural	control	p value
Age (years)	67.2 ± 1.0	67.5 ± 1.8	NS
Tobacco (packs-years)	57.6 ± 6.5	65.3 ± 6.3	NS
AAA diameter (cm)	6.5 ± 0.3	6.2 ± 0.5	NS
FEV ₁ /FVC	51 ± 2.7	49.7 ± 2.1	NS
PCO ₂ (mmHg)	38.3 ± 0.7	39.9 ± 1.9	NS

Table 2

Postoperative pulmonary complications after AAA repair

Complications	Epidural (n = 78)	Control (n = 41)	p value
Pneumonia	6 (7.69%)	5 (12.1%)	NS
Bronchospasm	7 (8.97%)	5 (12.1%)	NS
Respiratory failure necessitating intubation	0	2 (4.87%)	NS
Atelectasis	3 (3.84%)	4 (9.75%)	NS
Prolonged mechanical ventilation (>72 h)	0	3 (7.31%)	0.05
Postoperative oxygen dependency	0	0	NS

Table 3

Patient primary endpoints

	epidural	control	p value
No. days of mechanical ventilation	0.4 ± 0.2	2.5 ± 1.0	< 0.05
No. days in ICU	2.5 ± 0.3	4.3 ± 1.3	< 0.05
Length of stay (days)	12.1 ± 1.4	15.2 ± 3.1	NS
Pulmonary complications	16/78 (21%)	19/41 (46%)	0.05

Discussion

The prevalence of AAA in the general population has been reported to be 4 or 6%. In contrast, patients with COPD have a relatively higher prevalence of AAA that ranges between 7 and 11% [2, 3]. COPD patients with AAA are often discouraged from undergoing an open AAA operation due to high incidences of post-operative morbidity and mortality [5]. A recent population-based study by Lindholt and colleagues that examined the natural

history of AAA in patients with COPD showed not only a higher aneurysm prevalence among these patients, but also a different aneurysm progression pattern when compared to the general population [2]. Their findings were similarly supported by a clinical study that noted more non-fatal pulmonary or cardiac complications in COPD patients undergoing elective aneurysmorrhaphy procedures [11]. Moreover, multicenter study that examined clinical outcomes of veterans undergoing elective AAA repair showed a decreased survival rate among patients with COPD when compared to those without pulmonary disease [12]. In addition, smokers have also been shown to be at higher risk for postoperative pulmonary complications with relative risks ranging from 1.4 to 4.3 (compared to nonsmokers) [13]. Indeed, Warner et al. analyzed prospectively 200 smokers undergoing coronary bypass surgery. In the group that was able to abstain from smoking for at least 8 weeks prior to their operation, there was a reduced incidence of pulmonary complications (14.5 vs. 33%).

In spite of these various reports which documented poor clinical outcomes in COPD patients undergoing elective AAA repair, Eskandari and colleagues recently reported that the presence of severe home-oxygen dependent COPD was not a contraindication to AAA repair [14]. In their study, a total of 14 COPD patients with documented PFT underwent successful elective aortic aneurysmorrhaphy without perioperative death. The utility of PFT as a predictor of postoperative pulmonary complications has been evaluated previously. It has been found that an FEV1 of less than 50% of predicted value and an FEV1: FVC ratio of less than 70% correlate with an increased risk of postoperative pulmonary morbidity [10]. The patients analyzed in our study, similar to Eskandari's report, underwent preoperative PFT evaluation. Patients in either of the two studies had similar pulmonary dysfunction with two FEV1: FVC ratio being 51 and 52% respectively. However, the higher pulmonary complication rate in our report (epidural group 24% vs. control group 49%) may be due in part to our strict definition of a respiratory complication, since there was no difference in the perioperative mortality rates in either the epidural or control group.

Cunningham and colleagues initially evaluated the utility of epidural anesthesia nearly two decades ago when they reported its usage in 100 consecutive patients [15]. These researchers demonstrated a reduction in general anesthetic and narcotic requirements as well as a decline in postoperative pain on a subjective scale. Since then, several articles have analyzed the effect of epidural analgesia on intraoperative hemodynamics during AAA repair as well as the postoperative pain management [16-18]. The authors believe that a consensus exists

in the literature for the role of epidurals in contributing to a more stable operative course and less postoperative respiratory mechanics [16, 18-21]. The findings from our study similarly supported the beneficial role of epidural analgesia in patients with COPD undergoing aortic aneurysmorrhaphy, as evidenced by a significant reduction in postoperative mechanical ventilation duration and length of ICU stay. Potential complications that are specific to the epidural catheter placement that include postoperative hypotension, insertion site infection, and neurological sequelae were not observed in either of our patients groups.

The ideal surgical approach in patients undergoing aortic aneurysmorrhaphy has been broadly debated as several researchers advocate the retroperitoneal incision may potentially reduce postoperative pulmonary morbidity. At our institution, we prefer the transperitoneal midline approach for AAA repair because of its relative ease in obtaining wide exposure as well as straightforward access to the pelvis. In a prospective randomized study by Sicard and colleagues who compared the outcomes between transperitoneal versus retroperitoneal incision for aortic aneurysmorrhaphy, they noted that the retroperitoneal approach was associated with fewer overall postoperative complications and shorter hospital stays [22]. While patients with retroperitoneal incision experienced greater incisional pain, these researchers noted no significant difference in postoperative pulmonary complications between the two groups. The potential benefit of retroperitoneal approach in reducing postoperative pulmonary morbidity following AAA repair was similarly supported by several other studies [23, 24]. In contrast, a prospective randomized study by Cambria and colleagues failed to find a significant difference in postoperative pulmonary complications between the retroperitoneal and transperitoneal approach in patients undergoing AAA repair [25]. Interestingly, their results noted a significant reduction of postoperative pulmonary complications in patients treated with epidural anesthesia and local anesthetics. A possible mechanism for the reduced pulmonary morbidity was that epidural narcotics and local anesthetics provided both analgesia and muscle relaxation, which avoided large doses of systemic narcotics and thus permitted adequate respiratory performance by the diaphragm and accessory respiratory muscle [15].

In conclusion, our results suggest that epidural analgesia is beneficial in patients with COPD undergoing open AAA repair, as evidenced by the reduced ICU length of stay and shortened duration of mechanical ventilation. Our findings may due in part to the theoretical benefits of epidural analgesia that reduces postoperative abdominal pain and potentially allows deeper inspiration and

improves respiratory capacitance. Therefore, we recommend liberal use of epidural anesthesia in patients with COPD undergoing abdominal aortic surgery.

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