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EFFECT OF EPIDURAL ANAESTHESIA ON PULMONARY FUNCTIONS IN PATIENTS UNDERGOING UPPER ABDOMINAL SURGERY UNDER GENERAL ANAESTHESIA.

Dr. R Kavitha — M.D (Anesthesia) * Senior Assistant Professor of Anesthesia Institute of Anaesthesiology, Govt. Rajaji Hospital, Madurai Medical College, Madurai – 625020. - corresponding author

Dr.Evelyn Asirvatham — M.D (Anaesthesia) Professor of Anaesthesia Institute of Anaesthesiology, Govt. Rajaji Hospital, Madurai Medical College, Madurai – 625020.

ABSTRACT **Background:**Postoperative respiratory dysfunction is universally observed after abdominal and thoracic surgery. Abnormalities that contributes to reduced lung volume and hypoxemia in postoperative period include impaired central ventilator control, abnormal pulmonary mechanics due to limited abdominal, intercostal, and diaphragmaticmuscle contraction and changes in pulmonary circulation and gas exchange. In this study, forced indices are used to compare the pulmonary function tests in postoperative period as they are maximally depend on respiratory muscular effort and are affected the most in this period. Other pulmonary function test parameters are least affected in the immediate postoperative period. Methods: 82 patients of ASA (I & II) undergoing upper abdominal surgeries were randomly assigned in two groups, Group GA and Group EGA Patients of both the groups were explained and demonstrated about the pulmonary function testing procedure. Pulmonary function test was done using timed spirogram and the values of forced indices (FEV1, FVC, and PEFR) were recorded before surgery and 30 minutes after surgery. Results: Reduction of FEV1 by 29% - 41% in patients of GA Group whereas only20% - 28% reduction in EGA group. Reduction of FVC by 31% - 41% in patients of GA whereas only 21% - 29 % reduction in EGA group. Patients of GA group showed reduction of PEFR by 28% - 40% whereas in EGA group PEFR reduced only by 20% - 30%. Hence it can be concluded that epidural analgesia reduces the impact of general anesthesia and pain on pulmonary function in the postoperative period.

KEYWORDS : Epidural anesthesia, pulmonary function test, spirometery, postoperative period

1. INTRODUCTION:

It is a well-known fact that surgery and anaesthesia perturb the normal physiology of a patient. All the systems in the human body are affected and the pulmonary system is not an exception. Many factors responsible for postoperative pulmonary dysfunction include anaesthetic, surgical and patient factors.[1] Postoperative pulmonary dysfunction is an entity with multifactorial causes. The patient anaesthesia surgery triad act in an interdependent way in the pathogenesis of this dysfunction. Reflex stimulation during airway instrumentation and release of inflammatory mediators by drug administration, increasing airway resistance and limiting expiratory gas flow from the lungs.[2] If severe this can produce hyperinflation with risk of baro trauma and gas exchange abnormalities. Impairment of normal mucocilliary transport by anaesthetic gases and endotracheal intubation which may delay clearance of pathogens and promote retention of secretions.[3] .Impairment of lung inflammatory cells function by prolonged anaesthesia and surgery ,which could increase susceptibility to postoperative infections.[4] Impaired upper airway reflexes postoperatively with may increases the risk of aspiration .Incomplete reversal of neuromuscular blockade. These effects of anaesthesia can persist into the postoperative period, and through different mechanism the effects of surgical trauma also come into play. During recovery from general anaesthesia, there is a gradual increase in neural and muscular activity. The resting pulmonary indices like tidal volume recover in parallel with the reduction in plasma levels of drugs. But the forced indices of pulmonary function which help in maintaining airway, clearing secretions, prevention of atelectasis and hypoxia recover in an unpredictable fashion that is dependent on patient, anaesthesia and surgery factors.[5] It takes variable period of time for patients to regain their pre-operative levels of pulmonary function. Before the recovery, they succumb to hypoxia, infection; poor wound healing and retained secretions. It is the duty of the anaesthesia care provider to reduce the impact of factors that cause the pulmonary dysfunction. Hence, it is clear that, when postoperative patients are relatively pain free, their pulmonary function is improved. They can readily expand their chest, breathe deeply, cough well and cooperate with physical therapy. They are therefore less likely to develop atelectasis, hypoxia and pulmonary infection and more likely to recover quickly and uneventfully.[6]

Pain can be alleviated via intravenous opioids,[7] NSAIDS or neuraxial blockade. Since the former has their own disadvantages like respiratory depression, gastritis and PONV, the beneficial aspects of neuraxial blockade has made its role in improving pulmonary function in the postoperative period overcoming those disadvantages. of neuraxial analgesic techniques, epidural offers more versatile advantages of less hemodynamic effect, extensible duration, depth and area of analgesia.[8] They also provide better suppression of surgical stress, positive effect on postoperative nitrogen balance, more stable cardiovascular haemodynamics, reduced blood loss, better peripheral vascular circulation and better postoperative pain relief. This study was undertaken with the aim of evaluating the effect of epidural anaesthesia on pulmonary functions in patients undergoing upper abdominal surgeries under general anaesthesia. The parameters compared in the study are FEVI [Forced expiratory volume at 1st second] FVC [Forced vital capacity], PEFR [Peak expiratory flow rate].

2. METHODS:

A prospective randomized double blind study was done to evaluate the effect of epidural anaesthesia on pulmonary functions in patients undergoing upper abdominal surgery under general anaesthesia. The study was carried out in 82 adult patients at Govt Rajaji Hospital, Madurai. Patients in the age group of 20 – 60 years with BMI < 28 were selected for the study.Patients with chronic obstructive pulmonary disease, smokers, expected intraoperative blood loss > 500ml and skeletal deformities were excluded from the study. Only patients of ASA I and II physical status were chosen to avoid the influence of other medical illness. They were divided in to two groups with 42 patients in group GA and 40 patients in the other group EGA. For upper abdominal surgeries group GA were given general anesthesia alone and group EGA were given both epidural and general anesthesia. History, Clinical examination, relevant investigations – Hemoglobin, Renal function tests, Electrolytes, Informed consent from patients.

Study was conducted after getting consent from ethical committee. Patient was explained about the procedure completely and demonstrated. Pulmonary function tests were performed in supine position preoperatively and 30 minutes after surgery (postoperatively). After attaching the nasal clip and placing the mouthpiece in mouth with lips completely surrounding the mouthpiece, patient was instructed to take deep inspiration rapidly and exhale with maximal force without pause to get best results. The three parameters of forced indices FEV1, FVC, PEFR were recorded. This manouvre was repeated three times and the best of three results was chosen.

Epidural catheter was fixed in group EGA patients before induction. Tuohy needle (18 G) was introduced in the epidural space by the loss of resistance method at the level of T9 – T10 interspace. A catheter (20 G) was inserted through the needle and fixed with its tip at T6 – T7 interspace. Test dose of 3ml of 1.5% lignocaine with epinephrine 15mics was given to rule out intrathecal or intravascular spread.Epidural analgesia was continued postoperatively for 24 hours after surgery.All patients were premedicated with inj Glycopyrrolate 0.2mg im and inj Midazolam 0.05mg/kg im 45 mins before surgery after performing pulmonary function test. All patients were induced with inj propofol 2mg/kg, inj fentanyl 2mics/kg, inj succinylcholine 2mg/kg iv and intubated. Inj fentanyl and inj atracurium were used for intraoperative maintenance in titrated doses. Patients were reversed with inj neostigmine 40mics/kg and inj glycopyrrolate 20mics/kg iv and extubated on table.

POSTOPERATIVE PERIOD:

Pulmonary function tests were performed in the same manner as did in the preoperative period 30 mins after surgery. Three parameters of forced indices (FEV1, FVC, PEFR) were recorded again and the best of three results were taken and compared.

STATISTICAL TOOLS:

The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using Epidemiological Information Package (EPI 2010) developed by Centre for Disease Control, Atlanta.Using this software range, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated. Kruskul Wallis chi-square test was used to test the significance of difference between quantitative variables and Yate's chi square test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

TABLE 1: COMPARISION BETWEEN TWO GROUPS

FEVI Value	FEVI values (in %)						'p'
	GA group			EGA group			
	Range	Mean	SD	Range	Mean	SD	
Pre operative	62 - 78	71.0	4.3	60 - 80	69.6	4.8	0.1167 Not significant
Post operative	17 - 46	35.4	6.3	34 - 63	44.8	6.8	**0.0001 Significant**
Change	16 - 48	35.6	6.6	14 - 32	24.8	4.2	**0.0001 Significant**
FVC	**FVC values (in %)**						**'p'**
	GA group			**EGA group**			
	Range	**Mean**	**SD**	**Range**	**Mean**	**SD**	
Pre operative	60 - 79	70.4	5.7	60 - 80	68.4	5.5	0.0948 Not significant
Post operative	17 - 47	34.1	6.1	30 - 56	43.3	6.1	**0.0001 Significant**
Change	26 - 54	36.3	5.7	12 - 35	25.2	4.6	**0.0001 Significant**
PEFR	**PEFR values (in %)**						**'p'**
	GA group			**EGA group**			
	Range	**Mean**	**SD**	**Range**	**Mean**	**SD**	
Pre operative	60 - 80	70.4	6.0	60 - 80	69.0	6.0	0.2173 Not significant
Post operative	11 - 50	36.7	9.0	20 - 57	44.1	8.3	**0.0001 Significant**
Change	22 - 49	33.7	6.2	17 - 42	24.9	5.4	**0.0001 Significant**

3. RESULTS&DISCUSSION:

The two groups were comparable with respect to age, sex, weight, diagnosis, procedure done and duration of surgery Immediate postoperative period it will be cumbersome for the patient to do the spirometry test in sitting position with epidural anaesthesia, supine position was chosen in this study for both preoperative as well as postoperative period. As the procedure was done in supine posture, the initial preoperative pulmonary function tests results were reduced than the expected 80% of the predicted value.Hence the study was standardized in such a way that all patients in the study group underwent the pulmonary function tests in supine posture both in preoperative and postoperative period.

FORCEDEXPIRATIORY VOLUME IN 1 SECOND:

The preoperative FEV1 in both groups (GA and EGA) were comparable. In the postoperative period, patients in EGA group performed the pulmonary function tests well compared with GA group. The reduction in postoperative FEV1 from the preoperative value is only 24.8 + 4.2 % in group EGA compared with group GA where the reduction was 35.6 + 6.6 % and which was statistically significant.

This outcome is comparable with the study conducted by H. Hendolin and his colleagues, which was published in Acta Anaesthesiologica Scandinavica which concluded TEA significantly prevented the postoperative deterioration of respiratory function as compared with general anaesthesia.[9]

FORCED VITAL CAPACITY

The preoperative values of FVC both in group GA patients and in group EGA patients were comparable. The postoperative value of FVC was reduced by 36.3% + 5.7% from the preoperative value. Whereas in group EGA the reduction of FVC from the preoperative value was only 25.2% + 4.6% which again goes by the study conducted by H.Hendolin et al and Guay Joahne et al which concluded that TEA improves the forced vital capacity (FVC), (P = 0.001) at 24 h.[10]

PEAK EXPIRATORY FLOW RATE

The preoperative values of PEFR were comparable in both GA and EGA group patients. There occurred 33.7% + 6.2% reduction of PEFR in the postoperative period in group GA patients. Whereas only 24.9% + 5.4% reduction of PEFR occurred in group EGA patients.

Hence it is clear from the study that overall pulmonary function improves even in the immediate postoperative period with epidural anaesthesia compared with general anaesthesia only. This study correlates with the study conducted by Scott et al and Daniel M Popping et al which concludes the overall improvement in lung function with epidural anaesthesia in the postoperative period.[11]

Postoperative respiratory dysfunction is universally observed after abdominal and thoracic surgery. Abnormalities that contributes to reduced lung volume and hypoxaemia in postoperative period include impaired central ventilatory control, abnormal pulmonary mechanics due to limited abdominal, intercostals, and diaphragmatic muscle contraction and changes in pulmonary circulation and gas exchange. These abnormalities are due not only to sequele of operation itself, such as tissue injury or pain, but also to residual effects of anaesthesia and analgesia.

It is necessary to alleviate pain and improve the respiratory muscle tone as early as possible to prevent postoperative pulmonary complications and promote early recovery. It is a well-known fact that epidural technique is simple to perform, safer in skilled hands , and less time consuming. By this epidural analgesia, postoperative problems of major abdominal surgeries are overcome.

In this study, forced indices are used to compare the pulmonary function tests in postoperative period as they are maximally depend on respiratory muscular effort and are affected the most in this period. Other pulmonary function test parameters are least affected in the immediate postoperative period. Reduction of FEV1 by 29% - 41% in patients of GA Group whereas only20% - 28% reduction in EGA group.Reduction of FVC by 31% - 41% in patients of GA whereas only 21% - 29 % reduction in EGA group. Patients of GA group showed reduction of PEFR by 28% - 40% whereas in EGA group PEFR reduced only by 20% - 30% hence it can be concluded that epidural analgesia reduces the impact of general anaesthesia and pain on pulmonary function in the postoperative period.

4. CONCLUSION:

Epidural anesthesia can be provided safely in appropriate patients undergoing major abdominal surgery. It offers a number of proven benefits as a result of pain relief, improving the respiratory muscle tone and hence pulmonary function.This study concluded that pulmonary functions are significantly improved by epidural anaesthesiathus emphasizing epidural anaesthesia can significantly decrease pulmonary morbidity.

5. ACKNOWLEDGEMENT:

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