



REVIEW ARTICLE

A CLINICAL EVALUATION OF VARIOUS ANALGESIC AND ANAESTHETIC TECHNIQUES FOR ENDOSCOPES

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ABSTRACT

Aim: To evaluate the efficiency of different analgesic and/or anaesthetic techniques for endoscopy and complications associated with it.

Materials and methods: The present study of 350 patients between the age group of 1-85 years was carried out at Fathima institute of Medical sciences. The study included patients posted for endoscopes with diagnostic as well as therapeutic indications.

The types of scopes included are (1) oesophagoscopy, (2) bronchoscopy. The scopes used were rigid as well as fiberoptic scopes. Three techniques were used –

- Topical anaesthesia,
- Topical anaesthesia with sedation and/or a analgesia,
- Balanced general anaesthesia.

Drugs used for sedation were as follows - They were used in combination as well as a sole agent intravenously prior to the procedure.

- Pentazocine hydrochloride - 15-30 mg IV
- Pentazocine + Diazepam - Pentazocine 15 mg IV (fixed dose), Diazepam 5-10 mg IV depending on the requirement of the patient.
- Pentazocine hydrochloride + Promethazine hydrochloride - Pentazocine 15-30 mg IV and Promethazine 12.5-25 mg IV.
- Diazepam - 5-15 mg IV.

Result: The results obtained were analyzed and it was observed that local anaesthesia when supplemented with analgesic and/or anaesthesia, patients tolerated the procedure well and there was not much effect on haemodynamics.

Conclusion: The study concluded that topical anaesthesia with sedation sufficed for majority of patients and general anaesthesia is reserved for a small set of population requiring endoscopy.

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INTRODUCTION

'Endo-Skopein' is a Greek word, which means 'to examine within'. The development of endoscopic examination dates back to the end of the last century. In 1805, Bozzini (www.olympus-global.com/en/corc/history/story/endo/) reported the use of an endoscopic instrument with a wax candle as a light source to carry out examinations of the uterus and rectum. It was Kussmaul (www.olympus-global.com/en/corc/history/story/endo/) (1868) who prepared a rigid tube for oesophagogastrosocopy, using candle light with mirror as a reflector. It was Jackson's innovative approach that provided impetus to the development of bronchoscopy. In the recent years, Hopkins rod lens optical system with open-tube endoscope and flexible fiberoptic endoscopes have introduced exciting new dimensions to endoscopy.

As a result flexible fiberoptic endoscopy has to a great extent replaced rigid endoscopy as the procedure of choice for most endoscopic examinations. With the development of endoscopy, the art and science of anaesthesia for endoscopy also developed. Study of various local anaesthetic agents for topical application was carried out. Supplementation of sedatives and analgesics to topical anaesthesia was also studied. Along with various ventilatory techniques for general anaesthesia, Sanders (1967)(www.olympus-global.com/en/corc/history/story/endo/) introduced 'Venturi ventilation system'. Various improvements in that technique shortened recovery time and improved ventilation and arterial oxygen tension. The best methods for analgesia and sedation during gastrointestinal endoscopy are still debated. Providing an adequate regimen of sedation/analgesia might be considered an art, influencing several aspects of endoscopic procedures: the quality of the examination, the patient's cooperation and the patient's and physician's satisfaction with the sedation (Lorella Fanti, 2010).

The decision of local or general anaesthesia should be made depending on the Individual patient's problem and also the patient should have freedom from discomfort and pain. All the sensitive reflexes should be depressed, so making the procedure safe, smooth and minimal after-effects with speedy recovery. Patients should not have the memory for the events. All this will reduce the procedure incidence of complications, provide favourable conditions for the endoscopist and make the patient allow a second examination, if required, with pleasure. Endoscopy has got diagnostic and therapeutic indications. It is with this idea the study was undertaken to evaluate the efficiency of different analgesic and/or anaesthetic techniques for endoscopy and complications associated with it.

MATERIALS AND METHODS

The present study of 350 patients between the age group of 1-85 years was carried out at Fathima institute of Medical sciences. The study included patients posted for endoscopes with diagnostic as well as therapeutic indications. The types of scopes included are (1) oesophagoscopy, (2) bronchoscopy. The scopes used were rigid as well as fiberoptic scopes. Depending on the situation majority of the patients posted for the endoscopy had nothing by mouth for at least 6 hours prior to the procedure, except few patients who had undergone dire emergency procedures. The patients admitted in the ward were assessed and examined one day prior to the procedure whereas the patients from out-patient department and posted for emergency endoscopes were assessed one hour prior to the procedure. By assessing the psychological status and cooperation of the patients, their confidence was built-up by explaining them the details of the anaesthetic technique and endoscopic procedure. General examination and systemic examination was carried out. Special stress was given on the diseased or involved system. Routine investigations and relevant specific investigations for the diseases were noted. Written consent was obtained. Premedication was given with inj. Atropine 0.5mg for each and every adult and 0.1 mg for 1 year old patient and increasing by 0.1 mg for every one year increasing with age up to 5 years, 45 minutes prior to endoscopy. All the procedures were carried out in the operating theatre with all the facilities for resuscitation available.

Three techniques were used

- Topical anaesthesia,
- Topical anaesthesia with sedation and/or an analgesia,
- Balanced general anaesthesia.

Topical Anaesthesia

Bronchoscopy- Patient was taken on the table 5 min prior to the procedure. Topical anaesthesia was given by direct application of 4% xylocaine 2-3ml, with the help of small piece of tape gauze- to the lips, mucous membrane of the mouth, palate, anterior as well as posterior part of the tongue. After 5 min direct laryngoscopy was done gently and progressively till the tip of the epiglottis was seen and spraying was continued with the help of DeVilbis spray with 1-2 ml of 2% xylocaine on the posterior part of the tongue, in the vallecula and anterosuperior surface of the epiglottis. Local anaesthetic was also applied to both pyriform fossa and spraying continued on the posterior pharyngeal wall, posteroinferior surface of the epiglottis to go towards the

glottic opening and vocal cords with 1-2 ml of 2% xylocaine. In some patients a fine catheter was passed through the glottic opening and 1 ml of 2% xylocaine was sprayed through it, to get vocal cords and subglottic area anaesthetized as the patients used to cough with the first instillation of local anaesthetic agent. In few patients cricothyroid membrane puncture was done with the help of 20 gauge short, stout hypodermic needle and 2 ml of 2% xylocaine was injected through it. In all the patients, intubation was done with under sized tube. 4ml of 1% xylocaine was kept ready for injecting through endotracheal tube and Bronchoscope whenever required to prevent coughing. Even though total quantity of xylocaine used was ranged 220-260 mg, it was used over a period of 15-35 min and that too very conservatively, so not a single patient landed in xylocaine toxicity and had excellent analgesia. Oesophagoscopy - Patient was taken on the table 5 min prior to the procedure. Topical anaesthesia was given with the help of 4% xylocaine like bronchoscope. Spraying was done with the help of DeVilbis spray - on the lips, mucous membrane of mouth, to the tongue and palate. After performing direct laryngoscopy, spraying was continued more towards the oesophageal opening and also at the base of the glottic opening, which is likely to be touched by the scope. Most of the patients spitted out considerable amount of local anaesthetic along with excessive salivation, but quite a sufficient amount of anaesthetic was allowed to be swallowed. During the topical anaesthesia patients were monitored for vital parameters as well as for the signs of xylocaine toxicity.

Topical anaesthesia with sedation and/or analgesia

Drugs used for sedation were as follows - They were used in combination as well as a sole agent intravenously prior to the procedure.

- Pentazocine hydrochloride - 15-30 mg IV
- Pentazocine + Diazepam - Pentazocine 15 mg IV (fixed dose), Diazepam 5-10 mg IV depending on the requirement of the patient.
- Pentazocine hydrochloride + Promethazine hydrochloride - Pentazocine 15-30 mg IV and Promethazine 12.5-25 mg IV.
- Diazepam - 5-15 mg IV.

After giving topical anaesthesia like group (1), intravenous sedation was given on table. Close observation of consciousness, pulse rate, rhythm, blood pressure, respiration and colour was done.

Adequate effect of above mentioned techniques was judged by grading as below.

- Absolutely relaxed (++++) - Patient was not at all coughing. Procedure was well tolerated. Patient did not complain of pain and discomfort and was not restless.
- Comfortable (+++). - Very minimal, occasional coughing was there, procedure was tolerable and patient did not complain of pain and/or discomfort.
- Some discomfort (++) - Patient was mildly coughing in between and complaining of some discomfort and/or pain.
- Not allowing (+) - Patient did not allow the surgeon to carry out the procedure. Procedure was abandoned. Patient was kept on the next OT list and general anaesthesia was given from the start itself.

Balanced General Anaesthesia

Balanced general anaesthesia was given to the cases of emergency endoscopes, in small children and whenever required by the adult patient. Pre-oxygenation was done with 100% oxygen.

Inducing agents used were

- Thiopentone sodium 4 mg/ kg IV
- Inhalational agent 1-1.5%
- Ketamine 2 mg/kg IV

After inducing the patient, relaxation was achieved by giving succinylcholine hydrochloride 1.5 mg/kg. Patient was ventilated with bag and mask with 100% oxygen and handed over to the surgeon to proceed and complete the desired procedure. During this, whenever required, patients were ventilated by introducing the patient end of a proper size endotracheal tube in the proximal end of the bronchoscope. In the case of oesophagoscopy the patient was intubated with less than desired number of cuffed endotracheal tube and ventilated with oxygen and nitrous oxide. Relaxation was maintained with intermittent incremental doses of suxamethonium. During anaesthesia pulse rate, blood pressure, respiratory rate and colour of nails were observed. The clinical data was collected and analyzed.

OBSERVATIONS AND RESULTS

Majority of patients (247 out of 350) - 70.57% patients posted for the endoscopes were hospitalized. 92 (26.29%) were outdoor patients and 11 (3.14%) were posted for emergency endoscopes, even though they were hospitalized. The age of the patients posted for endoscopes varied from 1-85 years.

Majority (192 - 54.85%) were between 41-60 years. Total number of males were (241 - 68.86%) and females were (109 - 31.14%). Majority of the patients from the age group of 1-10 years had undergone bronchoscopy. Both rigid as well as fiberoptic scopes were used for bronchoscopy and oesophagoscopy. Study of various anaesthetic techniques was done in 350 cases. Out of these, 175 were given topical anaesthesia and 175 were given topical anaesthesia with sedation and/or analgesia using different drugs. 35 patients were given general anaesthesia using different inducing agents. In this study only topical anaesthesia was given with xylocaine to 175 patients. Grading of the patient was done depending on patient's comfort and cooperation. In this group 70(40.57%) patients were absolutely relaxed and 40(22.86%) were comfortable, 8 did not allow the procedure to be carry out.

In the second group of 175 patients who received topical anaesthesia with sedation and/or analgesia, each group had 35 patients. Comparatively results were good in the group receiving diazepam + pentazocine. 16(45.17%) were absolutely relaxed and 16(45.17%) were comfortable, so results were satisfactory in 90.34% patients. In the group who received diazepam only, 15(42.86%) were absolutely relaxed and 12(34.29%) were comfortable. All the patients in this group were cooperative, procedure was not abandoned in any patient. General anaesthesia was given to 35 patients posted for endoscopes using different inducing agents but in all muscle relaxant used was succinylcholine hydrochloride 1.5mg/kg IV. Out of 35 patients, 25 (71.43%) were posted for oesophagoscopy, 9 (25.71%) were posted for bronchoscopy and 1 (2.86%) was posted for oesophagoscopy + bronchoscopy. General anaesthesia was given to small children below the age group of 10 years and whenever required by the patients for some definite reasons. In the grade I patients, there was average pulse rate change of 18-22 beats/min and

Table 1. Table showing category of patients posted for Endoscopies

category of patients	Oesophagoscopy	Bronchoscopy	Oesophago+Bronchoscopy	Total
Hospitalized-elective	82(57.75%)	160 (78.82%)	5 (100%)	247 (70.57%)
Hospitalized -emergency	10 (7.04%)	1 (0.49%)	-	11(3.14%)
Out-door patients	30(35.21%)	42(20.69%)	-	92(26.29%)
Total	142	203	5	350

Table 2. Table showing age and sex distribution of patients in endoscopies

Age in years	Bronchoscopy		Oesophagoscopy		esophago+bronchoscopy		Total
	male	female	male	female	male	female	
0-10	2	5	3	1	1	-	12(3.43%)
11-20	4	4	1	1	-	-	10(2.86%)
21-30	12	4	8	5	-	-	29(8.29%)
31-40	21	10	14	9	-	-	54(15.43%)
41-50	38	18	21	11	2	-	90(25.71%)
51-60	50	9	26	16	-	1	102(29.14%)
61-70	16	3	9	11	1	-	40(11.43%)
71-80	5	-	5	1	-	-	11(3.14%)
81-90	2	-	-	-	-	-	2(0.57%)
Total	150	53	87	55	4	1	350

Table 3. Table showing the type of scope used for the various Endoscope

Type of scope	Type of scope used		Total
	Rigid	Fiberoptic	
Bronchoscopy	12(5.91%)	191(94.09%)	203
Oesophagoscopy	55(38.73%)	87(61.27%)	142
Oesophago+ Bronchoscopy	1(20%)	4(80%)	5
Total	68	282	350

Table 4. Table showing the number of the cases in series

Group	No. of cases
TOPICAL ANAESTHESIA	175
TOPICAL ANAESTHESIA WITH SEDATION AND/OR ANALGESIA	
a) Pentazocine	35
b) Pentazocine + Promethazine	35
c) Pentazocine + Diazepam	35
d) Diazepam	35
GENERAL ANAESTHESIA	35
TOTAL	350

Table 5. Table showing grading of the patients receiving only topical anaesthesia and topical anaesthesia with sedation and/or analgesia using different agents

Drug used	Oesophag oscopy	Bronchoscopy	Oeso+ Bronchoscopy	Total	Grading of patient comfort			
					+	++	+++	++++
Topical agent only	61	112	2	175	8(4.57%)	56(32%)	40(22.86%)	71(40.57%)
topical agent with sedation and/or analgesia								
a) Pentazocine	16	19	-	35	-	8(22.86%)	15(42.86%)	12(34.29%)
b) Pentazocine + Promethazine	11	24	-	35	-	9(25.7%)	13(37.14%)	13(37.14%)
c) Pentazocine + Diazepam	13	22	-	35	-	3(8.57%)	16(45.71%)	16(45.71%)
d) Diazepam	14	19	2	35	-	8(22.86%)	12(34.29%)	15(42.86%)
Total	115	196	4	350	8	84	96	127

+ = not allowing, ++ = slight discomfort, +++ = comfortable, ++++ = absolutely relaxed

Table 6. Table showing various inducing agents used for general anaesthesia for endoscopes

Type of scopy	Agent used for general anaesthesia			Total
	Thiopentone sodium	Inhalation agent	Ketamine HCl	
Bronchoscopy	23(95.83%)	2(40%)	-	2(71.43%)
Oesophagoscopy	-	4(80%)	5(100%)	9(25.71%)
Oesophago+ Bronchoscopy	1(4.17%)	-	-	1(2.86%)
Total	24	6	5	35

Table 7. Table showing pulse rate, blood pressure and respiratory rate changes during endoscopes

Pre-operative			Per-operative			Grading of patients
Mean PR /min	SBP mm Hg	Resp. rate/min	Mean PR /min	SBP mm Hg	Resp. rate/min	
88 ± 4	110 ± 10	18 ± 2	108 ± 6	120 ± 10	26 ± 4	+
86 ± 6	120 ± 6	20 ± 2	101 ± 4	124 ± 6	22 ± 2	++
88 ± 4	104 ± 6	18 ± 2	98 ± 2	104 ± 10	20 ± 2	+++
84 ± 2	110 ± 8	18 ± 2	88 ± 2	110 ± 4	20 ± 2	++++

+ = not allowing, ++ = slight discomfort, +++ = comfortable, ++++ = absolutely relaxed

Table 8. Table showing complications during and after endoscopes

Complications	No. of cases
Surgical emphysema	1
Oesophageal perforation	1
Bleeding in tracheo-bronchial tree during scopy	3
Total	5

SBP was raised by 10-20mm Hg and respiratory rate was raised by 8-12/min. 8 patients were coughing and were restless and were not allowing the procedure to carry out. In grade II group, average raise in pulse rate change was 10-15 beats/min and SBP was raised by 4-10 mm Hg. There was not much significant change in grade III and grade IV patients. All the parameters were maintained in grade IV patients. There was no evidence of arrhythmia during the procedure in any patient. Anaesthetic and surgical complications of the endoscopic procedures were also noted and follow up was done for these cases. Only one patient developed surgical emphysema after transtracheal injection of topical anaesthetic agent. Signs of surgical emphysema were seen 2 hours after the procedure, which was restricted to neck region only.

It gradually subsided after 2 days without any special treatment but was under strict supervision. In one patient posted for oesophagoscopy, had oesophageal perforation which was terminated ultimately into mortality. Another surgical complication was bleeding in trachea-bronchial tree during bronchoscopy, which occurred in three patients which stopped spontaneously within half an hour.

DISCUSSION

Endoscopy is a well accepted diagnostic and therapeutic aid to various diseases. The art of anaesthesia for endoscopy is also developing with the development of endoscopic instruments. It is a matter of controversy, which anaesthesia is better for

endoscopy, but this should not be dependent on personal preference and should be decided by considering the individual patient and his pathology. Generally endoscopy is considered as a 'minor' diagnostic procedure but it has been proved that mortalities associated with these procedures are very high. This increase in death rate created an awareness about the possible hazards associated with the procedure. Our study has been carried out on 350 patients posted for endoscopes in Fathima Institute of Medical sciences, Kadapa. Out of 350, 247 were hospitalized and had undergone elective endoscopy. 11 patients who were also hospitalized had undergone emergency endoscopy, 92 were out-door patients. Our study comprised of patients aged between 1-85 years of age, out of which 241 were males and 109 were females. Out of 350, 203 had undergone bronchoscopy, 142 had undergone oesophagoscopy and 5 were posted for combined oesophagoscopy and bronchoscopy. Majority -192 (54.95%) patients were between 41-61 years of age.

In the study, out of 203 bronchoscopes -12 (5.91%) were rigid bronchoscopes and 191 (94.09%) were flexible bronchoscopes. The scopes used were Jackson's rigid bronchoscope and Olympus fiberoptic bronchoscope. Out of 142 oesophagoscopes - 55(38.73%) were done with Jackson's rigid oesophagoscope and 87(61.27%) were done with Olympus oesophagoscope. In combined oesophagoscopy and bronchoscopy, fiberoptic scopes were used. The anaesthesia differs for rigid and fiberoptic, mainly the types, pattern and technique of ventilation during general anaesthesia. Because of non-availability of ventilating bronchoscope, we could not provide general anaesthesia as a routine. With rigid bronchoscopy incidence of requirement of general anaesthesia is high and will remain high. In comparison to fiberoptic scope, rigid bronchoscope as well as oesophagoscope are difficult to pass and cause more discomfort to patients. In our study of 350 patients, 3 groups of different analgesic and/ or anaesthetic techniques were studied. In the first group of 175 patients, only topical anaesthesia was given with 4% and/or 2% xylocaine. It was considered as a control group for our study. Out of total 175 patients, 61 were oesophagoscopes, 112 were bronchoscopes and 2 were oesophagoscopes and bronchoscopes. Grading was depending on the patient's cooperation. In this group 8 patients who were not allowing the procedure to be carried out were given general anaesthesia in the next sitting. 40.37% patients were absolutely relaxed. Slight discomfort was present in 32% patients.

Paterson, (1975) studied xylocaine blood concentration during fiberoptic bronchoscopy in 21 patients. They concluded that xylocaine offered a considerable margin of safety as a local anaesthetic agent for fiberoptic bronchoscopy. The potential for serious toxicity exists particularly in the critically ill and elderly patients. We agree with them that xylocaine offered a considerable margin of safety as a local anaesthetic agent. In the second group of 140 patients, 'topical anaesthesia' was supplemented with analgesia and/or sedation. 35 patients were selected randomly in each group. Total 4 groups were made. Topical anaesthesia was given with 4% and/or 2% xylocaine. All the patients received sedation immediately before the procedure intravenously. Grading of the patients was done. Results obtained were, all the patients who received 'topical anaesthesia with sedation' were cooperative, absolutely relaxed and allowed the procedure to be carried out as compared to Group I i.e., topical anaesthesia only. In the patients who received topical anaesthesia with sedation and/or analgesia,

results were good in the group receiving Pentazocine+ Diazepam, as compared to others groups. 45.71% patients were absolutely relaxed and 45.71% patients were comfortable. Only 3(8.57%) patients had discomfort. In the diazepam group 15(42.86%) patients were absolutely relaxed. It was observed that after giving pentazocine, the doses of diazepam required for the patient was reduced as compared to the only diazepam group. Patient had good analgesia-amnesia. There was no coughing, pain or restlessness.

Out of other 2 groups, in Pentazocine group 12(34.29%) patients were absolutely relaxed and in 'Pentazocine+ Promethazine' group 13(37.14%) patients were absolutely relaxed. As compared to only topical anaesthesia, majority of the patients in the sedation groups were absolutely relaxed and comfortable. There was no over sedation, difficulty in arousal of the patient or respiratory depression, vomiting, nausea in any patient. Not a single patient from this group required general anaesthesia. Our study was supported by a study conducted by Reed *et al.* (1971) on 106 patients for peroral endoscopy, they have concluded that, until neuroleptic analgesia is demonstrated to have definite advantage, conventional premedication with pethidine, promethazine and atropine is preferred and economically more acceptable. Rider *et al.* (1970) studied 20 unselected patients posted for endoscopes by giving IV Diazepam over a period of 2-3 min in an amount sufficient to produce slurring of speech. They concluded that diazepam is an effective and safe premedication for endoscopy. Ludlam *et al.* (1971) had given IV diazepam 0.2mg/kg before endoscopy after giving premedication with morphine and atropine 1 hour prior to the endoscopy. Topical anaesthesia was given with 2% xylocaine. A high proportion of the patients having diazepam had amnesia for the endoscopy. They concluded that an ideal premedicant for gastrointestinal endoscopy would remove patient's apprehension, render them relax but cooperative, have no side effects, be of brief duration with complete recovery of consciousness and coordination and perhaps, even cause them to carry a second examination with pleasure. In this trial, diazepam did not meet all these requirements, but it clearly went nearer to meeting them, than did morphine. A study conducted by Korttila and team (Rider *et al.*, 1970) suggested that midazolam offers no advantage over diazepam in terms of speed of recovery of psychomotor function, when doses of similar potency are given for bronchoscopy. We have chosen a group on diazepam to study the effects of diazepam as a sole agent. In our study, 35 patients received balanced general anaesthesia. It was given in small children, in uncooperative patients and whenever needed by the patient and/or requested by the surgeon. Out of 35 patients, 24 received thiopentone sodium as an inducing agent. In 6 patients induction was done with inhalation agent. In 5 patients, Ketamine was used as an inducing agent. Postoperative recovery was good in all the patients, drowsiness remained for a maximum of 30 min postoperatively.

No other complications with general anaesthesia were seen. Similar results were seen in a study conducted by Hameed Raafat *et al.* (2014) who concluded that GA serves as a more peaceful procedure for the patient and the operator than LA, but at the expense of recovery time and cost. In our study perioperative record of pulse rate, blood pressure and respiratory rate was done. In the grade I patients i.e., not allowing the procedure to be carried out, mean pulse rate was raised by 14-26 beats/min, blood pressure was raised by 10-20 mm Hg systolic and respiratory rate was increased by

8-12/ min. There was no such change in grades III and IV patients. In grade IV patients - pulse rate, blood pressure and respiratory rate remained in the normal range for those patients. There was no evidence of arrhythmia in any of the patients. Our study also indicates that topical anaesthesia if given in safer concentration, dose and sufficient duration of time provides a safe procedure for endoscopes. If it is supplemented with sedation, it provides good analgesia, amnesia and relaxation in patients. Complications associated with the procedure were surgical emphysema, hemorrhage and oesophageal perforation. Of these, surgical emphysema was the only anaesthetic complication and the remaining two were due to surgical procedure.

Conclusion

From the study, it can be observed that - most of the patients posted for endoscopes were out-door patients and maximum underwent fiberoptic scope. Further, it can be concluded that

- Topical anaesthesia is one of the best adjuncts for different endoscopes, irrespective of a analgesic and/or anaesthetic techniques used for the patients of extreme age groups in either sex and the combination fulfilled all the criteria required for ideal endoscopy.
- Balanced general anaesthesia was given in small children, uncooperative patients and whenever needed by the patients. Haemodynamic monitoring did not show any evidence of cardio-respiratory instability.
- In this study, the only one complication that occurred due to anaesthetic technique per se, was localized surgical emphysema, which subsided on its own.

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