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RESEARCH ARTICLE
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A SYSTEMIC REVIEW OF STUDY ON AFTEREFFECT & IT'S MANAGEMENT OF SUDDEN DEATH OF PATIENT AT ONSET OF OPERATIVE PROCEDURE

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INTRODUCTION-

Death associated with anesthesia and surgeries are death which occur in the operation theatre or before the patient has completely recovered from the effect of anesthesia. It is called death in the operation room and intra operative death. The use of opium like preparation in anesthesia is recorded in the Ebers papyrus of 1500b.c. India and china pioneered use of cannabis and aconite for anesthesia Sir Humphry Davy (1778-1829) used nitrous oxide (laughing gas)as an anesthetic in 1799

Aims & Objects-

We have to enumerate the cause of Death due to anesthesia and surgery
(A) In experience , Many deaths may occur due to inexperience and failure to
(B) Adopt precautions when clearly indicated like inadequate depth of
(C) Anesthesia, in adequate ventilation, post operative respiratory obstruction
(D) &intubation, of esophagus instead of trachea.

Clinical Factors

Under ventilation, Low blood volume, inadequate transfusion, anoxia, hypothermia, hyper pyrexia, inhalation of regurgitate material.

Surgical

(1) Was informed consent obtained for operation and the anesthesia.
(2) Was an operation under the anesthesia necessary?
(3) Was it essential to save the life of patient?
(4) Was the patient properly examined before the operation?
(5) Was he fit to undergo the said anesthesia and surgical operation?
(6)Was the patient suitably prepared for anesthesia & surgery?
(7)Were all anesthesia equipment in proper functioning order?
(8)Was the anesthesia and surgery performed by qualified doctors.
(9)Was there any defect in the surgical or anesthetic technique?

CRITERIA FOR INCLUSION AND EXCLUSION
INCLUSION CRITERIA
FOR DISCUSSING .
1 .Adult patient undergoing general anesthesia & surgery .
2. A.S.A Grade I

EXCLUSION CRITERIA
1 **..**patients who refuse to give consent.
2 .patients with base line heart rate <60 beats per minute ,base line systolic blood pressure<100mm hg and those with ECG abnormalities.
3 .patients with history of chest pain\ palpitation \syncope .
4. patients with sick sinus syndrome
5. hepatic and renal impairment
6 .patients in whom intubation is thought to be difficult.

REVIEW OF LITRETURE
Medical negligence was considered as a crime which is an offence against the state or the public for which the state is the representative of the people .it is the people who bring proceeding to prosecute the crime .
With the progress of civilization , medical negligence was increasingly treated as tort by the judiciary so that the victims can be provided with damages . As common law was evolving in England . the earliest recorded action against a medical man was done 1374 when a surgeon .i mort was brought before the king's bench concerning his treatment of An injured hand .he was not laible ,but the court said that if such a patient proved negligence. the court will provide a remedy. However of such greater significance , was the fact that the court also held if the surgeon does so well as he can and employs all his diligence to the cure .it is not right In 1395, William leech was found guilty of accepting fees without effecting cure. Holy roman emperor Charles I established an important concept of malpractice low.

He declared that medical malpractice must be judged by medical practioners. Almost three centuries later Samuel pepys in **1661** chided the doctors for their great negligence in failing to cure that duke of Gloucester of small pox. A vexatious allegation of ever there was one ,not unlike some present day claims
Seeking damages for failure to achieve perfection in an imperfect world succeeding centuries saw the rise of negligence law based on the law of torts Accordingly in **1838** C J Tyndall while determining the problem of proper standard of skill and care in a medical negligence suit said ' every person who enters a learned profession under takes to bring to the exercise of it a reasonable
Degree of care and skill.

Sir Humphry Davy (1778-1829) used nitrous oxide (laughing gas) as an anesthetic in 1799. He repeated the finding in a paper 1800.but it remained more or less as an entertaining agent. The first successful public demonstration of modern anesthesia was done on oct .16,1868 by William thomas green Morton (1819 1868) still a second year medical student. At the Massachusetts general hospital, He demonstrated that diethyl ether (originally called as letheon) could produce insensibility to pain in a practice of medicine forever .next year (1847), sir james young simpson (1811-1870) a Scottish doctor discovered the anesthetic properties of chloroform . however soon after anesthesia was introduced patient started to die during surgery .The 150 year since the introduction of anesthesia have been marked by the struggle to improve the safety of anesthesia care. Increasing instances of litigation on anesthetist and surgeon have necessitated
development in the investigation of anesthesia death . Death certificate must not be issued. Police is to be informed by the surgeon inall such deaths and an autopsy is conducted.

Obstetric anesthesia

(1)mendelson 's syndrome chemical pneumonia caused by aspiration during obstetric anaesthesia. May occur during any anesthesia, but common in pregnancy . because obstetric anesihetics are generally given in emergency situations without time for adequate patient preparation ,Ophthalmic anesthesia Inadvertent rubbing of the eye while it is numb can cause injury.

Spinal anesthesia

(1)Chronic adhesive arachnoiditis –if it involves cauda equine ,may cause dysfunction of bladder and rectum
(2)Hypotension . due to paralysis OF sympathetic outflow . particularly in old people whit preexisting heart disease
(3)Coronary insufficiency –may be precipitated
(4)cardiac standstill –due of inadvertent stimulation of the vagus nerve (5)permanent paralysis of ocular museles

causes of deaths associated with Anesthesia and surgery

Anesthesia may be general , or of some specified type. The causes of general Anesthetic and operative deaths are Causes of General anesthetic and operative death
(1) Deaths associated with anesthesia
(2) Deaths associated with surgical operation (a)Surgeon going through the strnum inadvertently
(3)Deaths by diseases

(a)those for which Anesthesia was given or operation preformed
(i) Emergency operation –A highly serious condition for which a last ditch attempt was made through surgery .e.g. explosive injuries .whit extreme fragmentation
(ii) High risk operation –e.g. Coronary bypass surgery. .heart transplant operation

(b)Other than those for which anesthesia was given or operation performd (!) hypertension , IHD, lung disease.

(A) Incidence

When mortality form anesthesia began to be seriously studied in The 1950s,the mortality rate was about 1/10,000 anesthetic administrations in otherwise healthy patients, the malpractice premium for anesthesiologists was about as high as that of surgical specialties. However ,due to the introduction of sophisticated monitoring devices, better training understanding of the physiologic effects of anesthesia and better transmission of information concerning causes of anesthesia mortality rate has fallen into range of 5-6 /million anesthetic administrations . At the same time ,the malpractice premium has fallen close to range of primary care physicians .(B)While deaths due to anesthesia are generally difficult to detect , those due to surgical operation and due to underlying diseases are readily detectable at autopsy.

A. Deaths associated whit anesthesia
(I) In experience –Many deaths occur due to inexperience and failure to adopt precaution when clearly indicated
(i) Inadequate depth of anesthesia- Intubation and bronchoscope may cause vagal inhibition if depth of anesthesia is inadequate
(ii) Inadequate ventilation- Hypoxia, sudden death due heart failure
(iii) Post- operative respiratory obstruction- by tubing or swabs.
(iv) Breathing circuit disconnections
(v) Between staff
(vi) Haste

(vii) Distraction
(viii) Excessive pressure on airway-repture of lung
(ix) Positive pressure ventilation-converts a simple pneumothorax into tension pneumothorax
(x) Intubation of esophagus instead of trachea

(2) Clinical factors-
(i) Under ventilation
(ii) low blood volume
(iii) inadequate transaction
(iv) anoxia (causes vertebral damage)
(v) Inadvertent hypothermia
(vi) Hyperpyrexia
(vii) Inhalation of regurgitated material (vomit), especially during the post-operative period

(3) Technical mishaps-
(i) Administration of incompatible blood
(ii) Infusion of wrong drug or fluid

a) Sodium citrate for normal saline. They are both colorless and have virtually similar labels. To avoids such errors, use distinctive labels and keep in separate cupboards
b) Anesthetic of greater strength than required
c) Ether injected in error for a local anesthetic. Labels should bechecked as well as odor to prevent such incidents

(iii) equipment failure
(iv) Inadvertent inhalation-of gauza and other swabs, dentures
(v) Mislabeling of oxygen and anesthetic gases
(vi) Explosions and fires-lgnition of inflammable mixtures are cyclopropane-oxygen and ether-oxygen. The spark may arise from a faculty electrical appliance, x-ray, apparatus and static electricity or from a surgical diathermy electrode.

1. Common adverse reactions associated with anesthetic agents.
2. Althesin- Violent bronchospasm Anaphylactic reactions-Dextran latex containing gloves may lead to an allergic response when the surgeon puts his hands into the patient's body.
3. Atropine-used in premedication, can cause hypoxia, especially in the presence of respiratory and cardiac disease. Can cause hyperpyrexia through interference with the beat regulation mechanism
4. Barbiturate IV-Overdose
5. Chloroform-Hepatotoxic. Rarely produces ventricular fibrillation
6. General anesthesia- Most common cause of sudden death ubder general anesthesia is acute neurogenic cardiovascular failure
7. Halogenated Hydrocarbon-e.g. cyclopropane, halothane trichloroethylene cause cardiac irritability by sensitizing myocardium to the action of adrenalione
8. Halothane-hepatotoxic, liver necrosis, malignant hyperpyrexia
9. IV infusions-can cause sir embolism (may also occur during surgical procedures.
10. Lignocaine-can cause generalized convulsions and death
11. Myo-neural blocking drugs-Respiratory inadequacy
12. Nitrous oxide-death is rare, but may occur due to over dosage, or when contaminated with nitric oxide. It can also cause a pneumothorax to expand rapidly
13. Careless use of relaxant drugs (e.g. curare) with IV barbiturate-
14. Paralysis of throat muscles. Suxamethonium- hyperpyrexia

15. Suxamethonium without atropine-Fatal bradycardia.
16. Thiopentone- if used in eardly and arteriosclerotic patient with IHD, may cause circulatory collapse
17. Trichloroethylene- Heart failure
18. IV administration of urea-Hypertension
19. Overdose of anesthetic agent-Depression of respiratory center Malignant hyperpyrexia (Malignant Hyperthermia)

Malignant hyperpyrexia malignant hyperthermia (MH) or malignant hyperthermia syndrome (MHS) is a rare life-threatening condition triggered by exposure to certain general anesthetics(specially all volatile anesthetics), nearly all gas anesthetic and the neuromuscular blocking agent succinylcholine Salient features

(1) Susceptibility to MH-is inherited as an autosomal dominant disorder
(2) Incidence and mortality-1,15000 pediatric anesthesia's and 1:50000 adults anesthesias.

Morality is about 10% (before the introduction of Dantrolene in the late 1970s, the morality was close to 80%). Occurs more in pediatric patients because many older people will have already had surgeries and thus would know about and be able to inform the doctor of their condition.

(3) Signs and symptoms-
(i) Muscular rigidity, followed by
(ii) A hyper catabolic state with increase oxygen consumption, increase carbon dioxide production (hypercapnia, usually measured by capnography), tachycardia (fast heart rate), and an increase in body temperature (hyperthermia) at a rate of up to 2.C per hour, temperature up to 42.c(108.F)are not uncommon.
(iii) Rhabdomyolysis may develop, as evidence of electrolyte disturbances.

(4) Tests- There is no simple, straightforwardtest to diagnose the condition.
(5) Treatment-dantrolene sodium.

B. Death associated with surgical operation

It is generally accepted that once the patient has recovered consciousness, Or been restored to his condition prior to the administration of the anesthetic, That anesthesia is not responsible for subsequent death. It must be due to other reasons. Cause of death due to surgical operation include.

(1)Inexperience-(i) Inadvertent mechanical disruption of a vital organ during a Procedure
(a) Catheter being passed into the coronary artery, right atrium, right Ventricle, or pulmonary artery perforates through

(2) Air embolism- Oecurs most commonly in
(i) surgery of the CNS –embolism of cerebral of cerebral venous sinuses when they are opened in sitting posture
(ii) during laminectomy drocedures
(iii) operation in the region of the axilla.(also associated with anesthesia .please see above)

(3)Massive hemorrhage – from sipped ligatures , uncontrollable oozing
(4) Accidental preforation of a viscous
(5) Nosoccomial infections.

C. Deaths by diseases.

In the majority of cases of death associated whit anesthesia the cause of death is disease.there are two broad groups
(a)those for which anesthesia was given (!)polytrauma
(2)severe biochemical disturbances-as due to prolonged acute intestinal obstruction (b)Other than those for which anesthesia was given-

(1)ID
(2)preyious emboil in calf veins- may get mobilized and case pulmonary embolism (especially in operations of the lower limb
(3)previous cardiac infarct –may cause hemopericardium
(4) Adenal hypoplasia – sudden collapse due to hypotension (5)pheochromoeytoma- fulminant hypertension
(6)I cusion pneumothorax- form ruptures of emphysematous bullae. VI.Investigation of deaths associated with Anesthesia and Surgery .

(^) Team -There should be an anesthetist and a surgeon (from a different hospital) in the investigating team to assist in the investigation In case of special surgical death e.g obstetric, neurosurgical. Pediatric deaths ets a specialist from the concemed specialty should be included.

(b) Questions before starting autopsy on a case ,the investigation team must ask lf self the following question In case of doubt, clarifications may be sought from mdependent surgeon or anesthetist

(1) Was informed consent obtained for the operation and the administration of aoedhetic
(2) was an operation and/or the administration of the anestgetic necessary in the circumstances
(3) was it essential to save the life of the patient
(4) was the patient properlyexamined before the operation
(6) Did the patient have any predisposing conditions ,which made him susceptible to death from the operation or anesthetic
(7) was the patient suitably prepared for anesthesia and surgery
(8) was asuitable form of anesthesia administered
(9) were all anesthetic equipment in proper functioning order
(10) was there any mislabeling of anesthetics or oxygen
(11) was the anesthetic administered and surgical operation performed by properly qualified and trained personnel
(12) was there any defect in the surgical or anesthetic technique
(13) were suitable and adequate arrangements made before the operation to deal with any emergency which might arise during the administration of the anesthetic
(14) when the emergency arose , were suitable steps taken immediately to resuseitate the patient
(15) were suitable and adequate arrangements made to ensure the safe recovery of the patient
(16) would the patient have died without the operation or anesthetic

(C) Exclusions and reasoning A prelmimnary investigations
1. visit to the operation room

(1)Check all equipment preferably in consultation with an independent anesthetist from a different from a different hospital check all valves and containers to ensure that there was correct mixing of percentage of gases.

2 History
(1) Obtain history of exposure to relevant and potentially toxic chemicals during

(a) The period prior to hospitalization (b)hospital stay (c)preanesthetic preparation (d)Anesthesia

(2)Obtain list –of relevant and potentially toxic chemicals associated whit each of these periods (3)thorough review of hospital chart (4)Hold diseussions with the surgical and anesthetic team .

3. Existing diseases.
A. Conditions requiring surgery .
Some surgical conditions are high risk per se eg resection of the aortic aneurysm and repair (surgeon may not be able to control bleeding)

B. Other pre-existing conditions
Some contraindication to operative are not easy to identify. Sometimes they are identified, but their seriousness is not appreciated.

(1)General
(i) Anemia
(ii)Hypertension
(2)Evs-

(i) Symptomless coronary artery disease-may proved fatal due to increased anoxia by anesthetic agents
(ii) Brown atrophy of the heart

(3) RS-
(i) Bronchitis
(ii) Emphysema
(iii) Interstitial pulmonary fibrosis

(4) Endocrine
(i) Myxedema
(ii) Thyrotoxicosis

4. Anesthesia
A. Preanesthetic medications
(1) Overmedication or no medication
(2) wrong medication

B. Anesthetic agents
(1) Get information about anesthetic agents used
(2) Check if method of administration was corrected
(3) Inadvertent wrong mixing of anesthetic agents may have occurred
(4) note duration of time the patient remained under anesthesia. Was it excessive?
5. Equipment
(1) All equipment including containers, valves etc must be checked in association with appropriate qualified personnel. (2) check if corrected mixing of gases was ensured.

6. Miscellaneous conditions
(1)Blood transfusion-Investigate mismatched blood transfusions
(2)Burns or explosions-rate cause of death due to anesthesia
(3)shock and hemorrhage.
7. Resuscitative measures- Note all resuscitative measures.

B. Autopsy

(1)Examine all device in situ

(i) Devices-attached to and inserted into the body must not be removed, either by the operating surgeon or nurse before sending body for postmortem. Common indwelling devices encountered are airways, chest tubes, indwelling catheters and needles, intravenous cannuae and wound drains

(ii) Autopsy pathologist-should open cavities with device in situ to know where the other end was reaching (e.g. intubation device may be the esophagus, thoracic drain pipe may be puncturing lung etc.) All devices must be checked for patency also.

(iii) Fluids in each cavity-Note presence, smell and volume etc. preserve for analysis

(2) Examination of operation site-Must be thoroughly examined although at time it may be difficult because of surgical alternations of the anatomy also because of the presence of hemorrhage adhesions, sepsis and edema etc

(3) Look out for artifactual finding

(i) Sutures from stomach and intestine may appear to have broken down it could however bean autolytic change

(4) surgical errors-

(i) Ligation of a wrong vessel, eg ligation of coronary artery, while implanting a heart valve prosthesis

(ii) inadvertent ligation of urter, bile duct

(iii) perforation of large bv

(iv) Inadvertent removal of a vital organ

(5) Odor-of anesthetic agent, in case of inhalation anesthesia

(6) All surgical sutures external and internal-must be examined. Whether they are intact or given way, whether infected etc.

(7) Viscera-Engorgement of dependent part-cannot be relied upon as a sign of prolonged anesthesia such findings may be seen after death due to passive gravitation

(8) Heart-Detailed examination. Histopathology may revel myocarditis

(9) Brain

(i) Hippocampus gyrus and cerebellum-show hypoxic changes.
The Ammons horns (syn, cornu ammonials, CA, hippocampus) are particular vulnerable, especially the Sommer sector (region CA!) and to a slightly less extent, the end folium. The selective necrosis in the sommer sector may be identifiable macroscopically if the patient survives for more than a few days.

(ii) Diffuse severe leukoencephalopathy of cerebral hemispheres with sparing of immediate sub cortical connecting fibers

(iii) Demyelination and obliteration of axon

(iv) Infarction of basal ganglia

(v) Damage is limited to white matter

(10) Disease for which operation was done-Check evidence for it.

(11) Check for common causes of intraoperative deaths-

(1) Detectable-

(a) Asphyxia form aspiraton of regurgitated material

(b) Embolism (air, fat)

(c) Cvidence of anaphylaxia and hypersensitivity

(d) Internal hemorrhage (e)Peritonitis

(f) Retained instruments and swabs. (iii)Undetectable-

(a) Cardiac arrhythmias
(b) Fail in blood pressure
(c) Spasms (coronary artery, laryngeal) (d) vagal inhibition.

1. **Samples to collect**
(1)Blood-for grouping cross matching etc. Collect blood of deceased, transfused blood, empty and half empty blood bags etc
(2)For cultureexudates. pus
(3)Sample from all organs-Histopathology
(4)For toxicology-Both lung must be tied and submitted for toxicological examination Other viscera as in standard toxicology death.

(i) Alvcolar air-collection procedure
(ii) Gases from cavities, heart and blood vessel-fill body cavity with water-use a rubber dam to trap gases before cutting the organ
(iii) If specimens or tissues are collected in a routine fashion, gaseous and volatile anesthetic may be lost due to exposure to air. To avoid such losses, it may be necessary to obtain sample by biopsy techniques prior to autopsy. This includes in tu encapsulation or freezing. Direct transfer of specimen from the body into hermetically scaled (air-tight) containers or analyzing solution. Sometimes even direct transfer to tissues into the gas liberating module of an analyzing instrument.
(iv) Many toxicological agents may not be detectable, despite having contributed to death. Thus failure to detect them does not exclude the possibility of death due to them
(V) Injection site –in local anesthetics

(S) Extraneous specimens (Specimens other than those from body)
(i) Medication containers
(ii) residual solutions
(iii) samples of operating room air .
(iv) samples of operating room air.

VII. legal aspects of Anesthesia .
A. Legal responsibilities of an anesthetist
(i) Role during illegal surgery
(ii) it is the duty of anesthetist to refuse anesthesia during illegal surgery (e.g. illrgal MTP, organ retrieval , amputation of healthy limbs for making beggars etc)
(iii) He must bring it to the notice of legal authorities .
(iv) If he administers anesthesia during illegal surgery he is a party to crime

DISCUSSION

(a) Dr Laxmanan prakash vs. state- patient died during the operation of fracture injuries on his leg during R.T.A reason for death was found to be long shock and acute respiratory failure, complication of spinal anesthetic .
It would amount to criminal negligence on part of anesthetist. His conviction under 304A of the IPC. Further failure on the part of orthopedic surgeons to check up performance of medical formalities through the anesthetist before commencing might reflect negligence which may attract civil low and not criminal low.
(b) The National Commission set aside the order of state commission with regard to the exoneration of the anesthetist and held him liable . However it agreed with the finding of state commission that in this case anesthetist was not negligent and liable for compensation, It also held that even if the services of the anesthetist were hired by the first

opposite party , then also the deceased happened to be the beneficiary of medical services of the anesthetist and hence a consumer and the service of anesthetist are invariably paid for by the patient themselves ,their charges being generally shown separately in the bill, section 2(1)(d)of LPA defines consumer asOne who hires or availsof any services for consideration.

The complainants husband suffered a cardiac arrest while under anesthesia for undergoing surgery in the medical college hospital . He sustained severe cerebral demnge due to lack of blood c cireculation and he lay in private ward of the hospital in a semieonseious state for one and half year ,The treatment at the hospital in a semieconseious state for one and half year . The treatment at the hospital was dee of charge as the patient had declared at the time of admission that his income

CONCLUSION

SUPREME COURT GUIDELINES

The pohe the members of legal profession . low courts and everyone coneemed will also keep in mind that a man in the medical profession should not be un neesarly harassed for purpose of interrogaton or for any other formality and should not be dragged during investigation at the police station . and should be avoided as far as possible. The low courts will not summon a medical professional to give evidence unless the evidence is necessary and even if he s summoned attempt should be made to see that the men in this profession are not made to wait and waste time unnecessarly.

The low courts always have respect for the men in the medical profession and they are called to give evidence when necessary and attempts are made so that they thay not have to wait for long.

It is expected of the members of legal profession to honour the person in the medical profession and see that they are not called to give evidence so long as it isnot neccassry. When the facts are so clear it is expected that unnecessary harassment to of themember of medical profession either by way of requests for adjournments or by foss examination should be avoided so that apprehension that man in the medical profession have which prevents them from discharging their duty to a suffering person who needs their assistance almost , is removed and citizen needing the passislance of a man in the medical profession receive it

PHYSICIANS RESPONSIBILITY IN CRIMINAL MATTERS

Ordmary under section 202 of IPC,it may be presumed that a medical Prathner should at one communicate to police any information about a Menial act that might have came to his knowledge in his professional work.

REFRENCES

1) Text look of forensic Medicine & Toxicology by Dr. Anil Agawae
2) Clinical forensic medicine & Toxicology by Dr. Anil Agarwae
3) Forensic medicine & Toxicology by Modi
4) Christoper, Schadi, introduction to the toxics species issue on ergot alkaloids to the toxics 2015,7(10) 4232-4237 doi 10.3390/Toxics 104232
5) Forensic Medicine & Toxicology by Parikh
6) Forensic Medicine, Toxicology by K.S. Narain Reddy
7) Text book of Medicine by Ginge & methew
8) Text book of surgery- Love & Baily
9) Text book of forensic medicine & Texicology Gautam & Bisuas
10) Text book of forensic medicine & Texicology by Kasmakar