SURGICAL APPROACH FOR REPAIR OF CLEFT PALATE IN CALVES

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Dedicated

to

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C E R T I F I C A T E

This is to certify that the thesis entitled "Surgical approach for repair of cleft palate in calves" submitted in partial fulfilment of the requirements for the degree of Master of Veterinary Science in Surgery of the Orissa University of Agriculture and Technology, Bhubaneswar is a faithful record of bonafide and original research work carried out by Shah Mohammed Abdussalam B.V.Sc. & A.H., under our guidance and supervision. No part of the thesis has been submitted for any degree or diploma earlier.

16.4.84

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(S.M.A. Salam)

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INTRODUCTION

INTRODUCTION

Cleft palate is a congenital anomaly affecting animals and human beings. Traumatic origin of a cleft or fissure in the palate, though possible, is a rarity. In human babies, cleft palate was considered to occur due to curse of God. In certain societies, it was believed to be associated with not observing certain superstitous restrictions by the pregnant women during the periods of lunar and solar eclipse. Occurrence of cleft palate in babies was considered as a bad omen (Pickrell, 1966) and the mother was the target for blame. Detail studies on this anomaly follows a revolutionary change in the attitude of man as a consequence to the scientific achievements during the period of RENAISSANCE. In animals the affected young ones were left to their luck because of lack of availability of a scientific approach for better management.

Gradually development of science and discovery of newer techniques made it possible to know at what stage in the foetal life, the growth is arrested and how the defect takes place. The degree of variation is wide enough in certain cases whereas in few others it might be negligible. In some, this anomaly might be associated with a few

other defects like harelip. Others may suffer from this anomaly alone.

Presence of fissure in the palate causes the food materials to pass into the nasal passage. From the nasal passage it has two alternative paths either to come out of the nostril or to get aspirated. In the young, when milk is sucked, it has the same fate. Advances in anaesthesia, artificial illumination, use of diathermy to check haemorrhage, etc made it possible to develop better surgical techniques for closure of the fissure and prevent inanition. But the successes in development of a good surgical technique for cleft palate in human babies have not influenced much in the field of veterinary surgery. Management of the young ones in case of animals is more difficult than in man. It is easier to keep the human baby in a controlled environment, feed scientifically and prevent disturbance to the surgical wound. In animals specially in calves and foals, the oral aperture is very narrow to permit any surgical interference. The advances achieved in canine oral surgery are difficult to be adopted in calves and foals. Hence, there has been a continuous search for better technique. Even now, anaesthetic techniques which are easily applicable to dogs, lack suitable adaptability in cattle.

The problem of cleft palate is more in cattle than in dogs, since it is thought to have a genetic origin. Breeding of cows in village condition, helps to propogate the condition when a single bull carries the defect. Thus, this condition has a greater impact on the village farmer who depends on a cow for some earnings. There is necessity to bring about a solution to this anomaly which would benefit the farmer immediately.

Artificial feeding is very difficult in calves. Surgical wounds are liable to be infected. Above all, economic consideration stands on the way for adoption of a developed technique which is expensive. The above consideration made the author to choose to confront the challange and to search for a better and easier technique which would ensure a cure in a good percentage of calves suffering from this anomaly.

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CHAPTER II
REVIEW OF LITERATURE

REVIEW OF LITERATURE

Cleft palate appears to be as old as the human race. The reasons for its occurrence are not fully evident. Most of the workers have stressed on the congenital and hereditary factors(Cawley,1965; Hammer et al., 1971; Munson, 1959; Patterson et al., 1966; Rothenberg, 1967; Setty, 1956). Even though mention about oral surgery is found between 2900 to 2750 B.C., a particular reference on cleft palate is lacking till ninteenth century when Simon P.Huliton (1810-1857) operated 60 cleft palate cases(Haris et al., 1963 and Benton, 1964).

INCIDENCE

In human patients, its incidence is reported to be one in one thousand (Pickrell, 1966). In dogs although not common, it is more frequently seen in short headed breeds associated with harelip (Knight, 1958). Setty(1958) encountered unilateral cleft palate with harelip in cocker spanial pups. Munson (1959) stated that cleft palate and harelip are usually congenital and are more commonly seen in puppies of Brachycephalic type. As cited by Cowlay (1965), its incidence is more common in English Bull dogs, Boston terriers and cocker spaniels. In these breeds the tendency is usually hereditary

and accompanied with harelip. According to him, acquired and traumatic form of cleft palate or similar lesions may result from trauma. Clifford et al. (1965) reported that fissures, clefts, fusions, furrows, unusual pigmentations, perforations, pits, contractures, as well as physiologic abnormalities are rare in animals. Thordel-christen son (1965) opined that congenital abnormalities of palate are not infrequent in animals but those of pharynx are rare, since the arrest in development of the soft palate occurs rarely. In dogs, he considered it to be fairly common developmental anomaly. Hammer et al.(1971) recorded a case of cleft palate in five week old pup (Toy poodle) in which left half of soft palate was absent.

Howard et al. (1974) reviewed the incidence of cleft palate in eighteen dogs of different breeds which were within seven weeks to one year and six months. They concluded that cleft palate might be encountered in any number of individuals within a litter.

Mason et al. (1977) encountered seven cleft cases in foals and claimed that though its occurrence is uncommon in these animals, it is well recognised congenital abnormality. Blood et al. (1979) considered cleft palate as one of the

commonest anomalies in cross bred cattle in Canada. Pure bred variety did not have such condition.

O'Conner(1980) described congenital fissures of the soft palate in horse, ox and dog and stated that it may either exist alone or may accompany some other anomaly in a monster foetus.

Wardrip (1982) recorded cleft palate in a five to six month old female kitten. The cleft extended from second premolar to the middle of the soft palate. He remarked that occurrence of cleft palate in cat is not common.

Bowman et al.(1982) recorded cleft palate is seven foals, two horses, two calves and concluded that the disease is of congenital origin. They further felt that cleft palate in domestic animals is an uncommon birth defect.

ANATOMY

The mammalian palate is a device which separates the oral cavity from nasal respiratory passages and thus makes it possible for the young one to suckle (Arey, 1962). It acts as the roof of the oral cavity and also as the floor of the nasal chamber. It is divided into two parts, the anteriorly situated is the hard palate while the posteriorly situated one is the soft palate. The hard palate is

bounded anteriorly by dental pad, posteriorly by soft palate and laterally by premolars, while the soft palate is bounded anteriorly by hard palate, posteriorly by epiglottis and laterally, molars with anterior and posterior pillars. Isthmus faucium is closed by soft palate. The bony portion of hard palate of cattle consists of (i) Horizontal part of the palatine bone, (ii) palatine process of maxilla and (iii) palatine process of premaxilla. The palatine ridges cover about two-thirds of the length of the hard palate. They number fifteen to nineteen. They are nearly straight and with the exception of a few at the posterior end are serrated on the free edge. A median raphe extends between the ridges. The posterior third of the palate is smooth. Between the dental pad and the first ridge there are foramina incisiva (Sisson, 1955, Habel, 1953).

Histologically, hard palate comprises of three layers viz. (i) upper mucous membrane of nasal cavity, (ii) the bony portion of the hard palate with its periosteum on either side and (iii) lower mucous membrane in the form of ridges which continues with soft palate. The mucous lining of the

nasal cavity also continues with that of pharyngeal region and the soft palate. In between the two mucous portions lie the muscular layers of soft palate. Soft palate is supplied with the branches of palatine arteries and veins and branches of trigeminal nerve (Sisson(1955); Habel,(1958).

Patten (1948) and McEwen (1957) described that, in the pig embroy, oral and nasal epithelium, and blood supply of palates are derived from the ectoderm; bones and muscles are derived from the mesoderm; and pharyngeal epithelium from the entoderm.

The nasal cavities in mammals, first develop from olfactory pits which quickly enlarge into blind sacs. The floor of each deepening sac then comes to overlie the roof of the front part of the primitive mouth and is separated from it by an oronasal membrane. The thinning membrane ruptures during the seventh week and so creates two internasal orifices, the primitive choanae. For a short time the two choanae open directly into the primitive oral cavity whose roof is merely the basal covering of the skull. This simulates the permanent condition in amphibia. Gradually the nasal passages become separate from the mouth which open behind into the pharynx. This is accomplished by means of a horisontal

partition that subdivides the primitive mouth cavity. The horizontal partition which divides the mouth from the nasal passages, is the palate. The primordial palate consists of sheet-like projection that grow from each maxillary process toards the mid plane of the mouth cavity. In their growth mesad during the seventh and eighth weeks, these lateral palatine processes encounter the tongue, which rises high at this period, and are forced to bend downwards. A little latter the tongue is withdrawn, due to growth changes and the lateral palating processes are then pushed upwards to the horizontal plane. The palatine halves unite with each other and then, with nasal septum. Begining in the ninth week, the fusion progresses rapidly from in front backward. Coincidently bone appears in the front part and forms the hard palate. More caudal, where union with nasal septum does not occur, ossification fails. This region constitutes the soft palate, the halves of its free apex, the uvula which are commonly stil notched at birth. Transverse ridges develop in the mucosal covering of the hard palate in case of most of the mammals. The folds of the soft palate are invaded from behind by tissue from third brancheal arches. Mesenchymal cells form muscles of the soft papate. The completed palate

shows a median seam or raphae. The median nasal process which participates so conspicously in the formation of the face, also developes into the so called median palatine process. The latter does not contribute to the palate itself but becomes premaxillary portion of the upper jaw. Fusion between the median palatine process and the palate becomes incomplete, resulting in a gap in the mid-plane, which is called foramen incisivum, ordinarily covered with mucous membrane (Arey, 1962).

Considering the physiological aspects of deglutition in man, Guyton (1976) reported that there are receptors in the soft palate which stimulate the deglutition centre of the brain creating reflex actions on pharynx, larynx, epiglottis, oesophagus, vocal cord and hyoid bones, when the food is pressed by tongue against the soft palate. The reflex actions are very much complex and, co-ordinative and instantaneous in nature.

AETIOPATHOLOGY

As stated earlier, cleft palate usually results due to failure in the fusion of palatine processes along the midline affecting soft and/or hard palate.

Knight (1958) mentioned that the defect results when the bones which form the hard palate, that is, the palatine, maxilla and premaxilla fail to unite, depending on the extent of the cleft. Thus there is a direct communication between oral cavity and nasal chamber. Setty (1958) encountered one pup which died within twenty four hours of birth due to cleft palate. The pup had two other affected litter mates who succumbed within a week. He studied the bony abnormalities of the skull in those animals and concluded that premaxilla was mostly affected. The cleft occupied the middle third of the above and on the left side which is the usual site of occurrence in human beings. Munson (1959) stated that cleft palate may escape detection on initial examination at birth in puppies but subsequently when they begin to nurse, it is easily diagnosed due to choking and acute difficulty in breathing. Geffen (1960) recorded cleft palate in a fourteen month old cat after being hit against the head of a car. The cleft extended from half an inch behind the incisors to the soft palate. Anteriorly it was a fine "line cleft", but posteriorly the cleft gaped about one third of an inch. The cat was always snuffing and sneezing after feeding.

Considering teratological aspect of man Arey (1962) described that occasionally the

lateral palatine processes fail to unite properly resulting in malformation. This is known as cleft palate or uranoschisis. The extent of the defects vary considerably and tend to affect part or all of the soft or hard palate or both at the sametime. In some cases it may involve the soft palate alone existing median in position, while in some others cleft in the hard palate may occur laterally. Further he observed that cleft palate accomapanies cleft lip; when doubled, the premaxilla tend to protrude prominently.

Clifford et al. (1965) reported that cleft palate and harelip are caused by both stress and genetic factors, since one without the other does not produce this abnormality. They also demonstrated that cleft palate could be experimentally produced in new born mice by administration of cortisone to pregnant females.

Thordel-Christenson (1965) is of the opinion that failure of structures to close the palate results in a cleft. According to him it is attributed to be hereditary. He also recorded that cleft usually occurs in the middle of the palate. The width of the opening varies from a

narrow slit to almost the entire width of the palate. The signs of cleft palate are apparent as soon as the puppy attempts to suck. The signs are nasal discharge, chocking, difficulty in breathing and coughing. He further noted that acquired cleft in the soft palate is often associated with haemorrhage, which stops spontaneously.

Patterson et al. (1966) reviewed genetic importance on hereditary diseases in dogs and concluded that most of the hereditary diseases which have so far been recognised are either gross defects such as skeletal malformations or internal disorders which may cause serious complications.

Pickrell (1966) stated that in the human beings during first two months of pregnancy, the tissues which are to form nose, lips, jaws and palate, normally grow from the sides to join in the midline to form the roof of the month (palate). According to him though cause or reason for cleft palate or cleft lip is not clear, hereditary trait is considered to have a definite role at least in approximately one quarter of the total cases. The remaining cases had no history of the condition in either side of the family.

Rothenberg (1967) also considered the condition to be a congenital one. In some it may

be hereditary. Enviornamental factors such as diseases like German measles, drugs like cortisones, stress and strain do influence during the early phase of development of foetus. He also claimed cleft palate to be the result of a recessive trait which may skip generations together and appear suddenly.

Small (1967) studied the effect of drugs during pregnancy in the human beings and concluded that cleft palate may be caused as a result of genetic factors and stress. Experimentally drugs such as cortisones when administered to pregnant female have been found to produce cleft palate in the new born. He also observed nasal discharge, chocking and difficulty in respiration.

Hickman and Walker (1973) reported that split palate in the cat is usually identified initially by epistaxis followed by other clinical signs of cleft palate. The injury comprised a central and longitudinal split of the hard palate complicated by separation of underlying palatine bones.

While reviewing the cleft palate in different breeds of dogs, Howard et al. (1974) opined the malady to be either genetical or acquired due to trauma or induced by stress or teratogenes.

Mason et al. (1977) reported seven cases of cleft palate in foals, all of which were congenital. There was great variation in its extent from one to the other. In some it affected soft palate while in others it involved hard palate. Affected individuals failed to suck. Nasal discharge was evident. In untreated cases death supervened due to starvation and aspiration pneumonia.

Blood et al. (1979) discussed aetiopathology of this malady in cross-bred cattle and Texel sheep and opined in favour of single recessive autosomal gene as the casual factor.

According to O'. Conner (1980) congenital cleft palate either may exist alone or it may be complicated with some other birth defects and cause nasal discharge, aspiration pneumonia, gradual wasting and finally death.

Wardrip (1982) observed malocclusion and cleft which extended from second premolar to the middle of the soft palate, in an old kitten.

Bowmen et al. (1982) encountered bilateral post prandial discharge, dysphagia and aspiration pneumonia in nine equines and two bovines suffering from palatal defects.

However, in contrast to the observation of others, Hammer et al. (1971) mentioned that though the condition occurs congenitally or after trauma, the genetic transmission of disease is in doubt and much more emphasis should be placed on the enviornamental factors.

ANAESTHESIA

Ever since the attention has been focused to repair of cleft palate in animals by surgeons, different types of anaesthetic technique have been employed. Satisfactory relaxation of muscles and jaws and adequate exposure of the mouth cavity are essential for surgical manoeuvre.

Chloral hydrate is still being used to induce general anaesthesia in cattle. Hall (1978) has mentioned different proportions of chloral hydrate and Magnesium sulphate mixture to induce deep narcosis and anaesthesia. Gadgil et al. (1978) preferred equal proportions of Chloral hydrate and Magnesium sulphate for general anaesthesia in buffalo heifers.

Schatmaum et al. (1980) employed xylazine for premedication with chloral hydrate @ 50 mg per kg body weight to induce general anaesthesia in calves aged between two weeks to six months. According to them Xylazine at higher doses or in combination with Chloral hydrate is suitable only when additional oxygen is given.

Mitra and Patel (1980) reported that a mixture of chloral hydrate and Magnesium sulphate in the proportion of 2:1 was satisfactory to induce general anaesthesia in calves of one year to two and half years. On the contrary, Bose et al. (1982) used Siquil* intramusculary followed by local infiltration of xylocaine for bilateral oral commissurotomy in calves.

In the openion of O' Conner (1980) the animals should be anaesthetised and positioned on dorsum for operation on palate. General anaesthesia has been used to repair cleft palate in dogs and ponies by different workers (Munson, 1959; Cowley, 1965; Nelson et al., 1971; Howard et al., 1974; Mason et al., 1977 and Bowman et al., 1982).

SURGICAL TREATMENT

Reports on the intraoral surgery and successful repair of the cleft palate in bovines are lacking. As stated earlier, surgical approach in the recent years has been directed towards adequate exposure of the oral cavity and improvised surgical techniques for the repair of palate defects.

O' Conner (1950) stated that, though treatment for the repair of congenital fissure of soft palate in animals is seldom undertaken in veterinary practice, it may possibly be attempted by performing staphylo-rrhaphy or uranoplasty. It

*

is difficult to suture the edges of the fissure or cleft in large animals due to depth of the mouth. He advised to freshan the edges of the fissure in staphylorrhaphy by means of long scissor or knife and to close the wound by interrupted silver wire sutures. While performing uranoplasty he suggested to give longitudinal incision on either side of the hard palate and raise flaps consisting of mucous membrane and periosteum before uniting the edges in the midline.

Petronius in 1565 utilised Gold plate to fill up the gap of hard palate and Fabricius in 1666 demonstrated the use of wire sutures for the repair of this condition (Hickman, 1964).

Palmer (1969) described the operative technique in man. According to him a linear incision is given on the hard palate close to the premaxilla and maxilla on either side. An "Arrow type head" shaped incision is given anteriorly which joins both the lateral incisions. Mucoperiosteal flaps are created. They are mobilised posteriorly and sutured. Anteriorly they are also sutured to the flaps created towards incisors.

Hammer (1971) demonstrated a method of anastomosis of rectangular flaps of pharyngeal

mucosa and sub-mucosa to the existing portions of soft palate in dog and achieved success.

Nelson et al. (1971) evaluated intraoral surgery via mandibular symphysiotomy approach in eight ponies and suggested that division of mandibular symphysis should be preferred to achieve adequate esposure of the oral cavity and pharynx. In their technique, the symphysis was immobilised postoperatively by pinning the mandibular rami in five ponies and by securing incisors with wires in three ponies. All the animals stood the operation wall and started eating within twenty four hours. Prehension and mastication were not apparently impared in any of the animals. They concluded that mandibular symphysiotomy provided adequate surgical exposure of hard palate, soft palate and oropharynx for intraoral surgery with standard surgical instruments. However, dehiscence of the lower lip incision was observed to be a frequent problem. It was due to the fact that lips of the horse are used as constant prehensile organs and thus subjected to continuous movement which prevent proper healing. They suggested either to secure the lower lip to the incisors by means of stainless steel sutures or to muzzle these animals and to feed them via nasogastric tube for the first ten days post-operatively.

Hickman and Walker (1973) reported that co-aption of the palatine bone is not easy but the breach can be occluded by co-aption of the mucous membrane of the hard palate in cat.

Lippincott (1974) narrated his technique for repair of cleft palate in dogs with thirty two colour illustrations.

Mason et al. (1977) described surgical repair of cleft palate in horses. They advocated the symphysiotomy approach to repair the anterior end of the soft palate while pharyngotomy was resorted to for the posterior part. Out of the total seven cases of palatoschisis, successful repair of the defect, which extended full length of the soft palate, was achieved in a 6-week old pony. In another two patients, though the defect was repaired successfully, they died due to unrelated reasons. They further cited the reports of repair of cleft palate in a seven year old horse (Kendrik, 1950), in an 11-day old foal (Strickle at al., 1973) and three successful cases, one of which died from pneumonia postoperatively (Jones et al., 1973).

Batstone in 1966 as cited by DeGeus et al. (1977) described the repair of cleft palate in two through breds and achieved success in the hard palate after second operation.

Bowman et al. (1982) reviewed the complications of cleft palate repair in seven foals, two horses, and two calves. They conducted mandibular symphysiotomy for reconstruction of the cleft palate and employed mucosal sliding flap technique for bridging the cleft in the hard palate. Mucosal edge surrounding to cleft in soft palate was incised for exposing the underlying tissues before commencing repair. They concluded that though mandibular symphysiotomy provided adequate surgical exposure for repair, serious post-operative complications could not be overcome. Dehiscence of a portion of the repaired cleft was encountered in all the cases and all the surviving animals exhibited chronic nasal discharge contaminated with food materials.

Bose et al. (1982) described an approach to the deep buccal cavity via bilateral oral commissurotomy in three experimental calves. The cheeks were repaired in three layers employing Vetafel or chromic cat-gut No.1 for the mucosal and muscular layers and nylon for the skin. They did not come across any post-operative complications.

CHAPTER III
MATERIALS AND METHODS

MATERIALS AND METHODS

(A) EXPERIMENTAL DESIGN

In the present investigation eight apparently healthy cross-bred Jersey male calves within 33 - 76 kg body weight and five to seven months of age were employed (Table-1). All the calves had been previously castracted. They were procured from the local market, maintained on balanced ration and were kept under normal hygienic conditions before being subjected to experimental creation of the cleft in soft palate.

The experimental calves were selected at random and marked serially, one to eight. They were divided into two groups (I and II) consisting of four animals in each group depending on the site of the approach.

Group - I. Experimental creation of cleft in the soft palate and its repair via bilateral commissurotomy. Calf Nos. 1, 3, 5 and 7 were allotted to this group.

Group - II. Experimental creation of cleft in the soft palate and repair via mandibular symphysiotomy Calf Nos. 2, 4, 6 and 8 belonged to this group.

(B) EXPERIMENTAL CREATION AND REPAIR OF CLEFT SOFT PALATE

1. Preoperative preparation and anaesthesia

The calves were kept fasting for twentyfour hours and water was withheld for twelve hours prior to undertake surgery. They were restrained and secured in lateral recumbency. The neck was slightly raised by keeping a sand bag underneath to keep the head downward so as to avoid aspiration of blood and secretion during the course of operation. The cheeks on either side or the lower jew, as proposed earlier according to the site of operation were thoroughly cleaned, shaved, washed with soap and water and painted with spirit acriflavine. The buccal cavity was irrigated with 1: 1000 potassium permanganate lotion. The operative area was covered with sterilised drapes exposing the site of incision.

General anaesthesia was induced by intravenou administration of chlor-mag anesthetic solution (Hall, 1978; Gadgil et al., 1978; Mitra and Patel, 1980; Schatzmann et al., 1980; Mitra and Patel, 1982; Mitra and Patel, 1982 A).

The anaesthetic solution (Dank's solution) was prepared by taking 500 ml of distilled water in which 50 gms of Chroral hydrate and 25 gms of Magnesium sulphate were dissolved. The solution

was made to boil for about 5 minutes and allowed to cool before administration.

Amounts of anaesthetic solution administered to different calves are given in Table - II.

The flask containing the solution was attached to an infusion set and administration was done under gravity through jugular vein. As soon as the neck and jaw muscles were seen to relax, induction was taken to be complete. From this point onward, administration was slowed down till a light second plane anaesthetic stage set in as assessed from absence of anal reflex. After about 30 minutes when the signs of recovery were evident, additional amounts of anesthetic were administered to bring back the animal to second plane of anaesthesia (Table II) so that operations are completed within the period.

A drip of 500 millilitre 5 per cent dextrose saline was started before beginning the operation.

2. Instruments

The following instruments were strelised by autoclaving.

(1) B.P.handle No.4 with blade No.24

(2) Haemostatic forceps (3) Towel clips

(4) Curved ordinary scissors (5) straight Mayo scissors (6) Gigli's wire saw with

T sheped handles (7) Bone Hand drill with Jacobs Chuck with twist drill of suitable size (8) stainless steel wire suture (9) Roger wire-cutting scissors. (10) Dissecting forceps (11) Muscle ratracotor (12) Medium sized curved traumatic and atraumatic suturing needles (13) Needle holder.

Required number of drapes, towel, gauze and bandage were also sterilized in the pack.

3. Surgical Technique

1. Bilateraloral commissurotomy approach

This approach was followed in four calves of Group I for the creation of a fissure in the soft palate. In three Calves repair was attempted. Calf No.7 was kept as control.

The head of the calf was secured in lateral position. Following the routine presurgical formalities an incision of about eight to twelve centimetres was given starting from the oral commissure. The incision was parallel to an imaginary line passing equidistant to the lower and upper premolars and extended posteriorly up to the facial vein. Subcutaneous tissues, orbicularis oris, buccinator muscle and the buccal mucosa were incised to provide a better exposure to the inner part of the oral cavity. The

head of the calf was then turned to the other side and commissurotomy was performed in the similar fashion on the opposite cheek. Haemostasis of the bleeding points could be achieved with the help of gauze pressure.

Following commissurotomy a midline longitudinal incision of about five to seven centimeters was given on the soft palate beginning from its pharyngeal end (Fig.1). The incision terminated at the hard palate. The palatine mucosa, palatine muscles and pharyngeal mucosa were divided along the line of incision. Palatal bleeding was checked by pressure with a swab soaked in normal saline. Nasal discharge consisting of blood and salivary secretion appeared at the nostrils when a satisfactory fissure in the palate was established. Extent of fissure and communication between the oral and nasal passages were carefully noted. The next step was the closer of the cleft. This was performed by uniting the incised edges of the soft palate by a single layer of suture continuously using chromic catgut No.2 (Fig.2). Buccotomy incisions were then closed in three layers. Firstly the mucous membrane was sutured in continuous pattern with catgut No.1 taking care to avoid undue tightening. Then muscles were approximated with chromic catgut No.2 in a simple continuous manner. The skin was closed with

interrupted mattress suture using monofilament nylon.

In calf No.7 cleft was created after commissurotomy. The cleft was left without repair in order to study the clinical signs post-operatively.

(2) Mandibular symphysiotomy

Surgical creation and correction of cleft via mandibular symphysiotomy was attempted in three calves of group II (Calf Nos. 2, 4, 6). Calf No.8 was kept as control after creation of cleft. A median skin incision was given in the intermandibular space commencing from the level of frenum linguae up to the lower lip measuring about ten to twelve centimetres (Fig.3). Mylohyoideus and Geniohyoideus muscles were divided along the line of skin incision with the help of Mayo scissors by careful blunt manoeuvre to avoid haemorrhage. Genioglossus muscle was carefully separated from the line of incision and then the oral mucosa was incised. Lastly the symphysis rami was divided by Gigli's wire saw. For achieving adequate exposure of the deeper parts of the oral cavity, the intermandibular skin incision was extended posteriorly for ten to fifteen centimetres. To avoid injury to the tongue, the deeper layer's of tissues consisting of Mylohyoideus, Geniohyoideus, Genioglossus and Styloglossus muscles were separated along the right lateral aspect. The division of

tissues including sublingual salivary gland and oral mucous membrane on this plane continued up to the level of pharynx. Due care was taken to leave sufficient amount of tissues on the medial aspect of ramus of the mandible to facilitate suturing during closure of the wound. Bleeding from symphysis region was checked with the help of forceps and gauze pressure.

The right and left halves of the lower jaw were then separated and held in position away from each other, fixing against the corresponding upper jaw. This step provided an easy approach to all parts of the oral cavity.

Cleft in the soft palate was then created and subsequently repaired in the similar manner as described in case of bilateral commissurotomy approach.

To begin with the repair of the symphysiotomy wound, all blood clots and secretion were wiped off and the two halves of the lower jaw were released to their normal position. Attempt was made to bring them in apposition gradually as suturing progressed. Closure of the wound was commenced by first suturing the oral mucosa continuously. The mucosal suture began from the posterior end of the incision using chromic catgut No.1-0. Initially

the stiches were kept loose. As approximation advanced suture were tightened. After completing the mucosal suture in the floor of the oral cavity up to anterior end of Genioglossus muscle, the gingival mucous membranes were approximated.

The areolar tissues below mucous membrane were sutured loosely. The muscular layers were brought in apposition by suturing in continuous pattern with chromic catgut No.2. The two parts of divided symphysis were retained in position with wire suture. In order to achieve this a drill hole was made through the rami of the mandible anterior to mental foramen (Fig.4). A wire suture was passed through the holes in the rami and tightened to keep the symphysis in proper shape (Fib.5). Skin was closed by longitudinal mattress suture using monifilament nylon (Fig. 6).

One calf (No.8) was kept as control without any repair of the cleft.

4. Post operative care

Following completion of repair of cleft palate by commissurotomy or mandilular symphysiotomy, the suture line on skin was painted with spirit acriflavin. Tetracycline hydrochloride* 500 mg was given intramuscularly daily for seven days. An

* - Oliecycline, Onkhard Ltd.

antiseptic ointment** was applied daily at the operative site to check secondary infection. 1 in 1000 potassium permanganate lotion was used to clean the buccal cavity daily till completion of recovery.

The experimental calves were kept under constant watch for any untoward complications postoperatively. They were fed initially for the first two to three days with liquid diet consisting of gruel and rice bran and then gradually returned to regular feeding.

5. Euthanisia

The calves were sacrificed by injecting saturated solution of Magnesium sulphate intravenously on the 12 day of operation. Post-mortem was conducted to study the pathological changes.

6. Post-mortem examination

Materials such as tissues from the repaired part of cleft at soft palate region and symphysiotomy lesions were collected at autopsy. Care was taken to collect the materials soon after the death, to avoid autolysis of the tissue. Tissues were preserved in 10 per cent neutral formal saline.

7. Histopathology

Soft tissues were trimmed into small pieces of 4-5 mm thickness, after eighteen to twenty four

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** - Himax, Indian Herbs and Research, Saharunpur (U.P.)

hours of their preservation for fixation. The tissues after trimming were kept again in freshly prepared 10 percent neutral formal saline for 3-4 days for better fixation. Tissues were then taken out from the formal saline solution and washed overnight under running tap water to remove formaline. They were dehydrated in different stages consisting of gradient alcohol starting from 70 per cent to absolute alcohol, 50 per cent alcohol-xylol, Xylol and xylol-paraffin, keeping for one hour in each of the solutions. These were then paraffin embedded and sections were cut at 4-5 micron and stained by routine Haematoxiline and Eosine staining technique (Gridley 1949). Microphotography was undertaken to demonstrate the histopathological changes.

Bony tissues were put to formic acid and sodium citrate solution. Daily fresh solution was changed. It was continued for 10 days. Bony tissues were decalcified (Gridley 1949). The rest of the procedure was followed as done for soft tissues following routine Haematoxiline and Eosine staining technique.

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CHAPTER IV

OBSERVATIONS & RESULTS

OBSERVATION AND RESULTS

The calves in Group I, were subjected to bilateral oral commissurotomy and the calves in Group II were exposed to mandibular symphysiotomy.

(A) GENERAL ANAESTHESIA

Group I : Bilateral Oral Commissurotomy:

Four calves were operated under this technique. They were brought under general anaesthesia using 10 per cent Chloral hydrate and 5 per cent Magnesium sulphate solution. The dose and duration are given in Table II and Table III respectively.

Calf No.1 was 7 months old, weighing 68.7 kg and required 75 ml of anaesthetic solution to come to deep narcotic stage. The stage was assessed by feeble response to pin prick at interdigital space. A period of five minutes was required to reach this stage. In order to get second plane surgical anaesthesia, 15 ml more anaesthetic solution had to be injected slowly as a drip. This was assessed by absence of response to pin prick at interdigital space and abolition of anal reflex.The animal showed signs of recovery after 24 minutes of onset in the middle of operation. An additional anaesthetic dose of 15 ml was required to bring back the animal to second plane of surgical anaesthesia which lasted for next

33 minutes. There was no untoward reaction during the anaesthetic period. Recovery of anaesthesia was uneventful. There was complete recovery in 87 minutes when animal could be able to stand and drink water (Table V).

Calf No.3 and 5 aged about nine months and six months old, weighed 76.90 kg and 46.50 kg. They required 85 ml and 50 ml of of Anaesthetic solution to come to deep narcotic stage (Table II) and the time taken was six minutes and five minutes respectively (Table III). First anaesthetic stage in the case of these two calves were 30 minutes and 28 minutes after administration of an additional anaesthetic dose of 17 ml and 10 ml. The second anaesthetic period continued for 32 minutes and 39 minutes when next dose of 17 ml and 10 ml were infused.

Mean age in this group was 7.33 ± 0.88 months, body weight 64.00 ± 9.08 kg and time taken for deep narcotic stage was 5.33 ± 0.33 minutes (Table III). Average amount of anaesthetic solution required for this stage was 70.00 ± 10.41 ml. To bring to the second plane of surgical anaesthesia the average amount of anaesthetic solution was 14.00 ± 2.08 ml (Table II) and the calves started to recover after 29.00 ± 0.58 minutes. Additional dose of anaesthetic

required to complete the operation was 14.00 ± 2.08 ml and the duration of anaesthesia after this administration was 34.67 ± 2.19 minutes. The calves recovered from anaesthesia within a period ranging from 87 minutes to 123 minutes with a mean of 100.67 ± 11.26 minutes (Table V). Even though calf No.5 was a weak one, it did not react adversely to anaesthetic at any stage but the period of recovery was little longer being 123 minutes which was thought to be exceptional.

Calf No.7 weighing 70 kg required 77 ml of anaesthetic to come to narcotic stage and a further dose of 15 ml induced second plane of surgical anaesthesia. Bilateral oral commissurotomy could be finished within this period. Duration of recovery stage was 85 minutes (Table II and Table V).

Group II: Mandibular Symphysiotomy:

Calf No.2 aged about three months and weighing 33.60 kg needed 35 ml of 10 per cent chloral hydrate and 8 per cent Magnesium sulphate solution to reach deep narcosis in 4 minutes. Administration of 7 ml more of anaesthetic solution induced second plane of surgical anaesthesia which lasted for 30 minutes. Anaesthetic stage had to be prolonged by additional anaesthetic dose of 7 ml inorder to

complete the operation of Mandibular symphysiotomy. Thus the total period of anaesthesia was 60 minutes. After anaesthetic stage the animal required 91 minutes for complete recovery (Table II,III,V).

Calf No.4 and 6 weighing 64.90 kg and 39.80kgp needed 70 ml and 45 ml of anaesthetic solution for induction, which took 5 minutes in each. For second plane anaesthetic stage 15 ml and 9 ml more of anaesthetic solution were required. Duration of anaesthesia was 59 minutes and 58 minutes in calf No.4 and 6 respectively. To maintain and prolong the anaesthetic period, further dose of 15 ml and 9 ml were required. They recovered from anaesthesia in 89 minutes and 94 minutes.

Mean age in this group was 5.00 ± 1.15 months, body weight 46.1 ± 9.57 kg, and time taken for deep narcotic stage 5.00 + 0.00 minutes (Table III). Average amount of anaesthetic required for this stage was 50.00 ± 10.41 ml. To induce second plane of surgical anaesthesia, amount of anaesthetic solution injected was 10.33 ± 2.40 ml. To maintain and prolong surgical anaesthetic period, anaesthetic soltuion in dose of 10.33 ± 2.40 ml (Table II) was necessary when they started recovering within a mean period of 29.00 ± 0.58 minutes. Subsequent mean maintenance period was 30.00 ± 0.00 minutes during which

operation could be completed. The mean recovery period was 91.33 ± 1.45 minutes (Table V).

Calf No.8 was 9 months old. It weighed 74.70 kg and required 80 ml of anaesthetic solution to come to narcotic stage. Another dose of 15 ml was required to induce surgical plane of anaesthesia during which period mandibular symphysiotomy and its repair could be completed. Duration of recovery was 88 minutes (Table II,V).

(B) SURGICAL TECHNIQUE

Group-I : Bilateral oral commissurotomy:

Bilateral oral commissurotomy provided enough space for closer view of the oral cavity. Cleft in the soft palate could be created without much difficulty (Fig 1).

During repair of cleft in the soft palate, it was difficult to take the first bite from the posterior end as the working space was very limited. Help of the needle holder was taken and suturing was begun from the anterior limit of the cleft. Maneuovre was comparatively easy. As suturing progressed towards the posterior end difficulty was encountered to move hands and instruments. With strainous effort it could be completed. This needed more time.

Bleeding from the soft palate was profuse while creating the cleft, but gauze pressure could reduce the bleeding to minimum.

Time taken for symphysiotomy, for creating the cleft, for repair of the cleft and for repair of the symphysiotomy were 8.33 ± 0.33, 2.00 ± 00, 8.00 ± 00 and 33.33 ± 1.33 on an average respectively (Table IV).

CLINICAL BEHAVIOUR

Clinical findings and post operative complication of cleft palate repair, as encountered in this study are presented in Table VII and Table VIII.

Group I: Bilateral oral commissurotomy:

Calf No.1 showed pneumonic signs from the first day of operation along with bilateral nasal discharge mixed with food materials. It exhibited signs of dysphagia while taking food. A sudden rise of body temperature to 104°F was marked on the eighth day of operation when administration of antibiotic was suspended. The animal gradually became dispeptic, anaemic, lithargic and refused to eat and drink. It died on the ninth day of operation (Table VI).

Calf No.3 looked apparently normal soon after operation without any complication. Calf No.5

had to be given 2000 ml of 5 per cent glucose saline by drip. Both the calves were able to stand and drink water without any difficulty after the recovery period. During deglutition of dry matters like straw, they exhibited signs of pain as marked by the peculiar movement of the head (Table VII).

Thorough vigilant inspection of the cleft after its repair in all the animals was necessary throughout the period of study. Dehiscence of a portion of the cleft occured in calf No.3 on the ninth postoperative day as evidenced by a slit like opening. In calf No.5 wide gap in the soft palate was evident on the seventh day of operation (Table VII). Subsequently similar clinical features like bilateral nasal discharge, dysphagia and cough were marked as in calf No.1. They died on the eleventh and ninth dayof operation respectively (Table VI).

In the control animal in which the cleft was left unrepaired showed the post-operative complication as in calf No.1 from very first day of operation and died on the fifth day of operation (Table VI).

Group II : Mandibular symphysiotomy:

This Group included calf Nos.2,4,6 and 8. Calf No.8 served as control. Following repair of the cleft via mandibular symphysiotomy, Calf No.2 and

6 looked comparatively brighter than the calves in Group I. They could be able stand and take their feed and water after the recovery period without any difficulty. Similar vigilant watch was also kept on them as in Group-I. Their daily pulse, temperature and respiration were within normal gange and they did not show any sign of difficulty or pain during deglutition. They masticated like normal animals (Table VII).

There was slight inflammatory reaction at the site of symphysis on the next day of operation in Calf No.2 which subsided in due course.

The calf No.4 showed some tendency to refuse solids. It started showing symptoms of pneumonia from third day onwards. On the fourth day lack of healing could be noticed at the region of lips, which started separating. Six sutures were removed, the edges were freshened and resutured. A visible non union of the cleft was noticed on fifth day. Gradually the gap got enlarged to the size of a pea. The body temperature got elevated and it was 105°F on fifth day. Other symptoms like bilateral nasal discharge and dysphagia were also noticed as experienced in calves of Group I. The calf died on the seventh day of operation.

Calf No.8 suffered typically similar to the calves of Group I from the very day of operation. It showed similar symptoms as calf No.7 and succumbed on the sixty day of operation.

All the animals including the control one exhibited slight shearing movement at the symphysis during mastication.

(D) POST MORTEM FINDINGS

Necropsies were performed soon after the death/sacrifice of all the animals and findings were recorded as in Table IX.

Group I : Bilateral Oral commissurotomy:

Repaired cheek wounds revealed complete healing in all the calves. Variable degrees of dihiscence were found in the cleft of soft palated. Upper and lower respiratory passages were filled with food materials. There was marked degree of congestion of mucous membrane of nose, pharynx and trachea. Some of the bronchi were filled with exudative fluid. Some lobes were highly congested. Some other lobes showed consolidation and atelectasis.

Digestive tract was partially empty.

Other body tissues did not show any pathological lesion, however there was marked degree of anaemia and dehydration.

The above changes were uniformly present in all the calves.

Group II : Mandibular symphysiotomy:

Calf Nos.4 and 8 revealed similar type of lesions on soft palate, respiratory passages and lungs as in calves of Group-I.

Calf Nos. 2 and 6 exhibited complete healing on skin, muscular tissue and mucous membrane of the wound created in the mandibular region. Mandibular symphysis showed non union. No abnormality could be detected in respiratory tract, digestive tract, lungs and other body tissues. Non union of symphysis rami was evidenced by looseness of their apposing surface.

(E) HISTOPATHOLOGY

Group I : Bilateral Oral Commissurotomy:

Histopathological study on this Group has not been done as they did not exhibit successful result.

Group II : Mandibular symphysiotomy

Microscopical examination of the tissues from repaired soft cleft palate in Group II (Calf Nos. 2 and 6) revealed no signs of necrosis and there was no infiltration with inflammatory

cells like neutrophils or no evidence of degenerative change. The healed up tissue showed evidence of granulation tissue with proliferation of angeoblastes characterised by formation of new capillaries, newly formed spindle shaped fibroblast and infiltration with lymphocytes and few neutrophils.

Mandibular bony symphysis did not reveal any angeoblastic cells.

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CHAPTER V
DISCUSSION

DISCUSSION

In the current Veterinary Surgical World Oral Surgery is still in infancy stage. Palatal operations are very much hazardous in nature and for its reconstruction multiple attempts are needed to achieve a success. To add to the miseries, differences in species and breed brings about a high degree of variation in depth, shape and size of the oral cavity. Oral defects are not only common in canines and equines but also frequently encountered in bovines. Inspite of these bottlenecks several surgeons in the recent years have diverted their attention towards oral surgery, more so for the repair of the cleft palate through different approaches in bovines and other species. (Nelson, 1971; Howard et al., 1974; Mason et al., 1977; Boss et al., 1982 and Bowman et al., 1982).

In the present experiment, eight crossbred Jersey male calves were used to assess the surgical efficacy of different approaches for adequate exposure of the oral cavity and repairing the cleft palate. Since the cattle are commonly used both in rural and urban sector for the purpose of cultivation, draught and milk yield, these animals are utilized extensively. Treatment for cleft palate in these animals attains greater priority. Further, in village conditions, where natural

breeding through locally available bulls is in vogue to a great extent, cleft palate condition continues to multiply and appear in a quite a good number of claves. It is justifiable to select calves of a few days old to try the experiment. No cattle owner would like to part with his young calf since weaning is not a practice in village conditions. Hence calves of a few months old were used in this experiment. Desi male calves are retained for draught purpose. Crossbred females are in great demand and are costly in view of implementation of a number of milk schemes including operation flood. Therefore, the only alternative was to carry the experiment in crossbred male calves. Further, the defect has no linkage to any particular sex.

(A) PREOPERATIVE PREPARATION

Correct positioning of the animal is considered to be on important factor for adequate exposure of the buccal cavity during intra oral surgery. Nelson et al. (1971) described positioning of animals in dorsal recumbency with the head and neck extended on the table to conduct mandibular symphysiotomy for adequate exposure. Hickman and Walker (1973) advised similar positioning in cat.

Howard et al. (1974) positioned the dog in dorsal recumbency for cleft palate repair. O'Conner (1980) opined that animals should be anaesthetised and positioned on the dorsum while operating on palate. Bowman et al. (1982) also preferd dorsal recumbency as recommended by the above workers.

In this experiment lateral recumbency was preferred for bilateral oral commissurotomy. Oral cavity was approached by having the animal secured in either lateral recumbency. The calves were positioned in left lateral recumbency during mandibular symphysiotomy as it was felt easy to work freely without any assistance to hold the calf for positioning.

Disinfection of the buccal cavity prior to the oral surgery utilising different antiseptic solutions has been reported. Nelson et al. (1971) utilized idophore antiseptic to disinfect the oral cavity of ponies prior to oral surgery after rinsing it with water to remove feed deberis from the buccal cavity. Howard et al.(1974) adopted similar procedure in dogs as used by Nelson et al. (1971). Bose et al. (1982) cleaned the buccal cavity of calves with 1:1000 potassium permanganate solution. Bowman et al (1982) generously rinsed the oral cavity

using dilute antiseptic solution (Betadine solution of Frederick Co., Purdu).

In the present experiment oral cavity was flushed with 1:1000 potassium permanganate solution as recommended by Bose et al.(1982).

The surgical site in fasting calf was prepared in the routine way by shaving, scrubbing and cleaning, followed by painting with spirit acriflavine solution. Nelson et al. (1971) mentioned about coating the part with iodophore antiseptic solution while Bowman et al. (1982) mentioned the preparation of the site by depilation and surgical scrub.

Preoperative antibiotic coverage helps in avoiding secondary infection of surgical wound. Howard et al. (1974) preferred broad-spectrum antibiotic therapy 12 hours prior to surgery. Bowman et al. (1982) prescribed antimicrobial therapy before surgery. Antibiotic therapy was initiated with Procaine Penicillin G or combination of penicillin and streptomycin by intramuscular injection in all of his clinical patients except one.

Here, in this experiment, tetracycline hydrochloride* was administered at the dose rate of 1000 mg per animal prior to surgery to provide a leading dose of antibiotic protection.

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* - Olicycline, Onkhard Ltd.

(B) ANAESTHESIA

Sufficient relaxation of the lower jaw is an absolute necessity to gain access into the depth of the oral cavity. Such a degree of relaxation is onlypossible under general anaesthesia. In cattle general anaesthesia is not usually preferred. But in view of the requirement, calves in the present experiment were anaesthetized for a second plane.

Chloral hydrate and magnesium sulphate solution in the concentration of 10 per cent and 5 per cent respectively were administered intravenously for the induction of deep narcosis followed by further administration for induction and maintenance of second plane of surgical anaesthesia.

Chloral hydrate and Magsulph solution in the strength of 2:1 has been recommended by Singh et al. (1974), Mitra and Patel (1980, 1982) and Mohapatra (1982). Danks (1943) as cited by Hall (1978) also prescribed similar preparation for inducing general anaesthesia in horses and farm animals.

In the present experiment anaesthetic solution was first injected at the dose rate of 1.1 ml per kg body weight to obtain stage of deep narcosis.

The mean quantity of anaesthetic solution administered to induce general anaesthesia was comparatively more in the group I than group II (Table II). This may be attributed to the comparative

difference in the mean body weight.

Following the administration of anaesthetic solution, the claves in the either group passed on to the stage of deep narcosis as evidenced by feeble response to pin prick at the interdigital space.

Soon after attainment of deep narcosis, the second dose of anaesthetic solution was given to achieve second plane of surgical anaesthesia. The mean quantity of chloromag solution administered was comparatively more in Group I. A further additional dose of the anaesthetic solution was again required to be injected to maintain and prolong the anaesthetic period for completing the operation.

Considering the duration of different stages of anaesthesia, it was noticed that the deep narcosis was achieved within 5.33 minutes in Group I, while it was within 4.67 minutes in Group II. Similarly the duration of anaesthetic period was slightly more in Group I than in Group II. Interestingly, there was no difference in the duration of the first stage of surgical plane of anaesthesia in either of the groups (Table III). These differences may be attributed to the variation of mean body weight and physiological status of experimental calves. However, the variations are within normal limit. Chloral hydrate induces deep narcosis within 4 to 6 minutes and addition of

Magnesium sulphate hastens the depth. Chloral hydrate is slow in crossing blood brain barrier (Hall 1978). Thus there is no abnormality in the present study.

According to Jones (1966) chloral hydrate is not considered to be a satisfactory anaesthetic because of its low pain releiving power. It severely depresses the vasomotor and respiratory centres and quickly attains the minimum lethal dose. To eliminate these undesirable effects, drugs like Magnesium Sulphate and pentobarbitone sodium have been recommended alongwith chloral hydrate for achieving a better depressant effect on central nervous system (Singh et al., 1971).

Vladutiu as cited by Hall (1978) narrated that inclusion of Magnesium sulphate hastened the onset of anaesthesia, increased its depth and reduced the toxicity of chloral hydrate. Further Hall (1978) citing Danks (1943) described that chloromag solution is less irritant than those of Chloral hydrate alone and that the mixture eliminates the relex irritability seen in some horses when using Chloral hydrate alone.

In this experiment preanaesthetic has been excluded. No serious untoward reaction has been found during stage of anaesthesia, recovery or post operative period.

Mixture of these above ingredient in concentration of 10 per cent and 5 per cent respectively at the dose rate of 1.1 ml per kg body weight acted well in this experiment to complete the oral surgical proceedures which is in accordance with the observation of Danks (1943), Hall (1978) and Mitra and Patel (1980, 1982).

The duration and recovery from anaesthesia were without any serious complication. The mean recovery period in Group I was 100.67 while it took 91.33 minutes in group II (Table III). Calf No.5 was initially weak and debilitated. Its recovery period was longer which has resulted in increase of the mean recovery period in Group I.

None of the animals showed symptoms of regurgitation which was probably due to complete fasting for a period of 24 hours and careful administration of the anaesthetic upto the desired depth. All the calves were able to walk within three to four hours. Due to weakness calf No.5, probably could not be able to walk even after four hours of operation. An extra postoperative care with 5 per cent glucose saline was required to restore the animal to normal function.

(C) SURGICAL TECHNIQUE

Cleft palate repair in bovines includes two phases of operation. First phase being approach to

the site of the cleft palate and the next is proper repair of the original cleft. Attempts have been made at different times to investigate on a satisfactory repair of cleft palate. In case of bovines, approach to the cleft is very limited due to small oral opening. Bowman et al.(1982) tried to ease the problem by performing mandibular sumphysiotomy in two calves aged about two weeks and ten days. They discussed post-operative complications in detail as both the calves succumbed. The number is too meagre to bring out all the problems connected with mandibular symphysiotomy in bovines.

The size of the cleft palate varies considerably in different individuals. Success of the repair of the cleft palate depends on the availability of tissues around the cleft. If the gap is more, success is doubtful. Further the approach to the site is also another complementary factor.

Considering all the above aspects, the approach problem is thought tobe more serious and immediate than the repair. In the present experiment comparisons have been made between two approaches viz., buccotomy and mandibular symphysiotomy. To conduct the operation, no highly

specialised instruments were required excepting a Bone hand drill with a twist pin of suitable size and Gigli's wire saw.

(1) GROUP-I : Bilateral Oral Commisurotomy

This technique for the repair of cleft in the soft palate was practised in calf Nos. 1,3,5 and 7, of which last one was kept as control.

Buccotomy approach for oral surgery particularly palatal operation at its posterior end in bovines do not seem to have been attempted much as seen from the perusal of litureture.

Incision on the cheek on either side was extended only for about 8-12 cms taking care to avoid damaging the blood vessels and Stenson's duct. Within this short distance there were no important structures which might get injured and create complication during post operative period.

In the bilateral oral commissurotomy technique, the approach to the depth of the oral cavity was not completely solved. This provided scope to view the cleft clearly. Repairing at the anterior protions of palate becme easier. Limitations in handling the deeper portions of soft

palate still persisted. It was not possible to obtain a closer view and to manipulate the instruments at that depth easily.

While closing the commissurotomy incision suturing was done in three layers. i.e. buccal mucosa, muscles and skin. This helped in achieving perfect healing despite constant movement of the cheeks.

Tolksdorff (1966) as cited by Bowman et al. (1982) suggested bilateral buccotomy to obtain a better approach for the repair of cleft palate in large animals. Bowman et al.(1982)opined that Buccotomy alone can not adequately expose the oral cavity for operating on the posterior extrimity.

(2) Group-II : Mandibular Symphysiotomy:

This technique was applied in the animals of Group-II consisting of calf Nos. 2,4,6 and 8. Calf No.8 was the control in which cleft of the soft palate was not repaired. Nelson et al.(1971). Mason et al.(1977)and Bowman et al. (1982) have described this approach for repair of cleft palate in equines and bovines and preferred since it provided adequate exposure of oral cavity and more

working space for soft palate repair.

In the present study neither lingual nor hypoglossal nerve was encountered during operation. Additionally, sublingual salivary gland was also not involved while operating.

In this technique posterior part of the soft palate could be conveniently repaired with standard instruments. There was sufficient working space to work with both hands to disect out/approximate and suture the two edges of the tissues in the soft palate.

The line of incision as suggested by Nelson et al.(1971) for equine was adopted for cattle. Careful blunt surgical maneuvre while dividing the Mylohyoideus and Geniohyoideus muscle with Mayo scissors helped in avoiding undue haemorrhage. Nelson et al.(1971) used an electrosurgical unit to control the haemorrhage.

Separation of the mandibular symphysis into left and right halves was achieved using Gigli's wire saw. Sawing was started by manipulating the wire saw from the posterior edge of the symphysis in anterior direction. This technique was felt convenient and easy. Nelson et al.(1971) also employed this technique in two of the eight ponies

while in the rest they preferred using an oscillating bone saw.

Adequate exposure of the deeper parts of the oral cavity was possible by extending the intermandibular skin incision to the level of pharynx as described by Nelson et al.(1971). Due care was taken to avoid damage to sublingual salivary gland and duct of mandibular salivary gland during separation of deeper layers of tissues consisting of Hylohyoideus, Genioglosus, Geniohyoideus and Styloglossus muscle.

Following the separation of symphysis the two halves of the lower jaw were held in position away from each other by fixing against corresponding upper jaw. This step provided sufficient exposure and an easy approach to all parts of the oral cavity. Nelson et al.(1971) also narrated that spreading apart the mandibular rami and hooking with the upper cheek teeth provided ready visualisation of hard and soft palate and oropharynx in equines.

Repair of the symphysiotomy wound was commenced by first suturing the oral mucosa continuously. Initially the stitches were kept loose and then tightened as the approximation advanced. This step

helped in proper closer of the oral mucosa. Dead space could be avo ded by suturing the loose areolar tissue below the mucosus membrane. Nelson et al. (1971) in their technique preferred placement of interrupted sutures both at mucous membrane and areolar tissue separately. In the present technique continuous suturing pattern was adopted over the interrupted pattern for avoiding unnecessary delay in completion of the operation. As regards the suturing materials, the use of No.1-0 chromic catgut was found to be fairly good and did not cause any post-operative complication like disruption or abscessation. Nelson et al. (1971) however mentioned to use 00 medium chromic surgical gut and achieved success.

Closure of the muscles was achieved by chromic catgut No.2 in a single layer technique. There was no untoward complication in any of the cases as marked clinically. Nelson et al.(1971) employed 1-0 chromic catgut in interrupted horizonta mattress pattern for suturing Geniohyoideus and Genioglossus muscles. For the Mylohyoideus muscle and subcutaneus tissues, they preferred 3-0 medium chromic surgical gut in simple interrupted fashion.

Stabilization of Mandibular symphysis in position was achieved with wire suture in the present investigation. The wire suture was passed through the holes drilled in the rami just behind symphysis and tightened. Nelson et al.(1971) fixed the mandibular rami by external fixation using two Steinmann's pins and connecting externally with a connecting bar. They further obtained additional stability by wiring the incisor teeth with 20 gauge stainless steel wire. Bowman et al.(1982) also recommended to stabilize the mandibular symphysis by using ASIF interfragmentary screw-fixation technique or Steinmann's pin combined with wiring of the lower incisors. Delay in the bone healing was observed in this technique. The reason may possibly be attributed to insufficient immobilisation from wiring.

(3) Creation and Reconstruction of Cleft Soft Palate:

Experimental creation of cleft was easily performed in mandibular symphysiotomy because of close vision and easy approach. In the bilateral oral commissurotomy even though it was possible to create a cleft in soft palate but it was more time consuming and cumbersome (Table IV).

No sooner a cleft was established, there was appearence of nasal discharge mixed with blood

and salivary secretion because of clear communication between the oral and nasal passages. This was taken as a sign of satisfactory creation of cleft.

Closure of the cleft in both the groups was performed by suturing the incised edges of the soft palate in a single layer using chromic catgut No.2. Mason et al. (1977) described the closure of the cleft by placing nine single interrupted sutures of polyglycolic acid material (Dexon, size-0). Following symphysiotomy technique they repaired the defect as far caudally as possible but did not extend to the epiglottis. Jones et al. (1971) preferred to close cleft in soft palate in three layers. De Gheus et al.(1977) while recommending the technique of Jones et al.(1973) advised for suturing the oral and nasal mucosa separatel and reinforcement of the oral mucosa with mattress sutures including palatal muscles. Bowman et al. (1982) repaired the cleit soft palate by suturing the nasal mucosa and the paletal muscles. They employed chromic gut (size 1-0/2-0/3-0) or silk (size 2-0) or braided polyester suture (size-1) in their suturing patterns. They tried continuous or interrupted or horizontal matress in the different cases but the repair was unsuccessful in some cases, most common site of failure being at the posterior

end of the soft palate. In the present experiment not much stress was put on cleft repair. There was variable degree of non union in the cleft as evidenced by oronasal fistula in all the animals of Group-I and in one animal in Group-II (Table VIII). Cook (1977) while critically assessing the success of cleft palate repair, opined that success should not be based just on restoration of normal structure but on restoration of normal function, which he considered to be more important. He described his experience on one horse out of six, which had undergone three radical operations comprising pharyngotomy thrice and mandibular symphysiotomy twice. Still then he could not achieve success. The caudal portion of soft palate had failed to unite.

In view of the above observations and findings in the present study, it is considered important that due attention must be given for proper surgical exposure up to the most caudal level of the cleft.

(D) POST OPERATIVE COMPLICATIONS

(1) Group-I: Bilateral Oral Commissurotomy:

Healing of the incision wounds in the cheeks progressed normally but complications

developed in the cleft because suturing of the edges could not be performed perfectly. Not only there was limited space for movement of the needle, there was difficulty in tying the knots properly. In case of cheek wounds, suturing in different layers could be done without any difficulty. Any loose knot or improper spacing of the needle while suturing were the possible causes for development of oronasal fistula at the repair site. Once a fistula developed the other symptoms like nasal discharge, bronchitis, respiratory distress were the resulting complications.

Food materials got aspirated into nasal passage through fistulous opening. From the nasal passage some of these aspirated materials were either excreted as nasal discharge or were further aspirated into the respiratory tract. After being aspirated into the respiratory tract, these materials were the cause of infection and irrigation. Fate of the animal depended on the gravity of infection.

(2) Group-II : Mandibular Symphysiotomy:

In this group approach to the cleft site was made via intermandibular space after dividing the symphysis rami. In this approach no difficulty

was experienced while either creating or repairing the cleft of the soft palate. Perfect apposition could be brought about in the cleft by maintaining proper spacing in the needle holes and avoiding any loose knot or loose fold.

Mason et al.(1977) and Bowman et al.(1982) repaired posterior parts of the oral cavity mostly in equines. They also expressed that they could conviniently complete the repair work.

In this experiment two calves showed (Calf Nos. 2 and 6) successful result while calf No.4 revealed unsuccessful findings both at the site of approach and on the cleft. Wound on lip did not heal up. It required second attempt to repair. However this was not a problem with other two calves (Calf No.2 and 6) and even with Calf No.8 which was the control animal. This was probably due to some post operative trauma and infection.

The control animal (Calf No.8) died earlier and the other (Calf No.4) died latter. The symptoms of bronchitis and pneumonia were clearly evident with rise of temperature, auscultative changes and depression.

All of the experimental calves were confined to their ward. They were stall fed in order to reduce the chance of outside traumas. But one

can not avoid abnormal movements of lips with an attempt to lick or feed.

The repair at the symphysis did not show complete healing. It did not exhibit osteoblastic movement as evidenced by histopathological findings. The reason was poor fixation. In absence of complete immobilisation, it was obvious to find shearing movement there by non union.

Nelson et al.(1971), Mason et al.(1977) and Bowman et al.(1982) faced similar difficulty of non-union in symphysis even though they immobilised the symphysis with Steinmann's pin and reinforced by wiring of incisors. Osteomyellitis developed in a few of their cases when the pins became loose.

In this experiment symphysis rami were apposed by using stainless steel wire suture through a drill hole which did not provide perfect stability.

(E) POST MORTEM FINDINGS

Group-I : Bilateral Oral Commissurogomy:

Respiratory tract complications were secondary due to non-union in the cleft. The lesions were similar to those described by Blood et al. (1979). The control animal had typical findings of

a pneumonic patient.

(2) Group-II : Mandibular Symphysiotomy

Calf Nos. 4 and 8 revealed pathological changes in the respiratory tract resulting from aspiration through oronasal fistula in the region of cleft. In the calf Nos. 2 and 6, no pathological changes were seen in respiratory tract because cleft repair was satisfactory.

(F) HISTOPATHOLOGY

Tissues from cleft palate of calf Nos.2 and 6 revealed granulation tissue formation as evidenced by fibroblastic and blood vascular changes. These signs are suggestive of normal progress in healing process (Fig. 7, 8).

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CHAPTER VI
SUMMARY

SUMMARY

In the present study an effort has been made to evaluate the surgical exposure for reconstruction of the cleft soft palate in eight cross-bred male Jersey calves, divided in two groups. Two surgical approaches viz. Bilateral oral commissurotomy and Mandibular symphysiotomy were practised.

In Group-I, four calves were subjected to experimental creation of cleft in the soft palate via bilateral oral commissurotomy approach. Surgical repair of the cleft was done in three calves while one was left as control. Similarly in Group-II following mandibular symphysiotomy approach, cleft was created and repaired in three calves. In the control calf the cleft was left unrepaired as in Group I.

Surgical anaesthesia was induced by chloromag solution in the concentration of 10:5 at the rate of 1.1 ml/kg body weight for inducing deep narcosis. The operative techniques as adopted in either of the approaches have been vividly described.

Satisfactory anaesthesia was achieved with intravenous administration of chloral hydrate and Magnesium sulphate solution. No preanaesthetic was administered and the animals tolerated anaesthesia

well without any untoward complications. The durations of mean total anaesthetic period achieved were 63.66 ± 2.35 and 59.00 ± 0.81 minutes in Group I and Group II respectively. Recovery periods as recorded were 100.67 ± 11.26 and 91.33 ± 1.45 minutes in Group I and Group II respectively.

As regard the positioning of the animals either side lateral recumbency was preferred for bilateral oral commissurotomy. The positioning in left lateral recumbancy was employed for mandibular symphysiotomy since it was felt to be easy.

During the operations, no highly specialised instruments were required. The only special instruments used were bone hand drill with a twist pin of suitable size and Gigli's wire saw, during symphysiotomy.

Experimental creation of the cleft in the soft palate was found to be convinient and easy in symphysiotomy than with commissurotomy approach. The mean time required to create the cleft was 3.00 and 2.00 minutes in Group I and Group II respectively.

Considering the efficacy and convenience in the procedure for the repair of cleft, it was found that bilateral oral commissurotomy approach provided sufficient working space for hard palate and anterior

protion of the soft palate. However, surgical maneuovre was difficult in the posterior portion of the soft palate.

Mandibular symphysiotomy approach although little cumbersome, provided sufficient surgical exposure and working space up to the most caudal level in the posterior soft palate.

The clefts were repaired in a single layer technique using chromic catgut No.2 and suturing all the three layers viz. palatine mucosa, palatine muscles and oral mucosa, together.

Closure of the commissurotomy wound was made with chromic catgut of suitable grades, and nylon suturing oral mucosa, the cheek muscles and skin separately. The wounds exhibited desired clinical healing. The mean time required for the repair of commissurotomy wounds was 28.6 ± 0.6 minutes.

In mandibular symphysiotomy approach, the floor of the mouth was closed in three layers. The stabilisation of mandibular symphysis was achieved with stainless steel wire suture passing through the rami just behind the symphysis. However it did not provide sufficient immobilisation. The mean time taken to complete the repair of symphysiotomy was 33.33 ± 1.33 minutes.

Post operatively, though the calves stood the operation well, there were concurrent complications

due to improper closure of the cleft in some of the calves. Complications like pneumonia, dysphagia, post prandial nasal discharge and dehiscence of the soft palate was marked in all the calves, following bilateral oral commissurotomy approach. When mandibular symphysiotomy was followed, the post operative complications were primarily noticed in one calf only out of the three.

Out of the total six cases of cleft repair, only two calves survived the entire period of observation, in which symphysiotomy approach was followed. The others succumbed following different post operative complications.

Histopathologically, the changes were found to be suggestive of the normal progress of healing process as characterised by granulation tissue formation at the site and without any signs of necrosis or degenerative changes.

It is concluded, therefore, that mandibular symphysiotomy approach provides adequate exposure of the oral cavity and sufficient working space up to the caudal level of soft palate. By this approach, surgical maneuovre was easy and repair of the cleft extending the full length of soft palate could be undertaken with a fair degree of success.

In the present investigation although the number of experiments undertaken is too meager to

draw definite conclusion, an elaborate study in larger number of animals is strongly warranted.

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for cleft palate repair in experimental calves

Type of surgical approach for cleft palate repair	Group No.	Calf No.	Age in months (approx)	Body weight in kg
Bilateral oral commissurotomy	I	1	7.00	68.70
		3	9.00	76.90
		5	6.00	46.50
			7.33± 0.88*	64.03± 9.08*
		7	8.00	70.00
Mandibular symphysiotomy	II	2	3.00	33.60
		4	7.00	64.90
		6	5.00	39.80
			5.00±1.15*	46.1±9.57*
		8	9.00	74.70

* - denotes mean ± SE

Group No.	Calf No.	Age in months (approx.)	Weight in kg	Amount of anaesthetic solution used (ML)		
				To induce deep narcosis	To bring to first anaesthetic stage **	To bring to second anaesthetic stage ***
I	1	7.00	68.70	75.00	15.00	15.00
	3	9.00	76.90	85.00	17.00	17.00
	5	6.00	46.50	50.00	10.00	10.00
		7.33±0.88*	64.00±9.08*	70.00±10.41*	14.00±2.08*	14.00±2.08*
	7	8.00	70.00	77.00	15.00	-
II	2	3.00	33.60	35.00	7.00	7.00
	4	7.00	64.90	70.00	15.00	15.00
	6	5.00	39.80	45.00	9.00	9.00
		5.00±1.15*	46.1±9.57*	50.00±10.41*	10.32±2.40*	10.33±2.40*
	8	9.00	74.70	80.00	15.00	-

* - Mean ± S.E.

**- Amount of anaesthetic solution used to bring to second plane of surgical anaesthesia after deep narcosis.

***- Additional amount of anaesthetic solution for maintenance to complete operation.

with chloral hydrate and Magnesium sulphate solution in experimental calves

Gp No.	Calf No.	Age in months (approx.)	Weight in kg.	Duration of different stages of anaesthesia (Minutes)			Duration of total anaesthetic period
				Deep narcosis	First anaesthetic stage **	Second anaesthetic stage ***	
	1	7.00	68.70	5.00	29.00	33.00	62.00
	3	9.00	76.90	6.00	30.00	32.00	62.00
I	5	6.00	46.50	5.00	28.00	39.00	67.00
		7.33±0.88*	64.03±9.08*	5.33±0.33*	29.00±0.58*	34.67±2.19*	63.66±2.35*
	7	8.00	70.00	6.00	30.00	-	30.00
	2	3.00	33.60	4.00	30.00	30.00	60.00
	4	7.00	64.90	5.00	29.00	30.00	59.00
II	6	5.00	39.80	5.00	28.00	30.00	58.00
		5.00±1.15*	46.1±9.57*	4.67±0.33*	29.00±0.58*	30.00±0.00*	59.00±0.81
	8	9.00	74.70	6.00	30.00	-	30.00

*-Mean ± SE

*-Duration of second plane of surgical anaesthesia after infusing second dose of anaesthetic solution after deep narcosis.

*-Duration of anaesthesia for maintenance to complete the operation after infusion of third dose of anaesthetic solution.

Table IV showing time required for completion of the operation in experimental calves

Group No.	Calf No.	Surgical technique	Time taken to complete the operation (Minutes)				
			For bilateral oral commissurotomy	To creat cleft	To repair cleft	To repair commissurotomy	Total
I	1	Bilateral oral commissurotomy	12	3	15	28	58
	3		12	3	14	30	59
	5		12	3	14	28	57
			12.00±0.00*	3.00±0.00*	14.33±0.33*	28.6±0.67*	58.00±0.58*
	7		12	3	x	28	43
			For mandibular symphysiotomy	To creat cleft	To repair cleft	To repair symphysiotomy	
II	2	Mandibular symphysiotomy	8	2	8	32	52
	4		8	2	8	32	52
	6		9	2	8	36	55
			8.33±0.33*	2.00±0.00*	8.00±0.00*	33.33±1.33*	53.00±1.00*
	8		8	2	x	32	42

* - Mean ± S.E.

Table V showing duration of recovery stage in experimental calves

Group No.	Calf No.	Recovery period (Minutes)
I	1	87.00
	3	92.00
	5	123.00
		100.67±11.26*
	7	85.00
II	2	91.00
	4	89.00
	6	94.00
		91.33±1.45*
	8	88.00

* - Mean ± S.E.

Group No.	Calf No.	Duration of survival (days)	Died or Euthanatized
I	1	9	died
	3	11	died
	5	9	died
		9.67±0.67*	
	7	5	died
	2	12	Euthanatized
	4	7	died
	6	12	Euthanatized
		10.33±1.67*	
	8	6	died

* - Mean ± S.E.

cleft soft palate.

Graoup No.	Surgical technique	Calf No.	Important clinical signs	R e s u l t
I	Bilateral oral commissurotomy	1	Post prandial nasal discharges mixed with food materials, dysphagia and pneumonic symptoms marked from the beginning.	unsuccessful
		3	Initially no complication marked. Animal looked apparently alright. A small oronasal fistula was visible on the 9th day followed by dysphagia and other allied complications were as above.	unsuccessful
		5	Initially alright and looked well. Dysphagia with liquid food. A wide oronasal fistule in the palate was marked on the 7th day followed by other complications as in calf No.1	unsuccessful
		7	Showed symptoms of dysphagia, pneumonia and post prandial nasal discharges mixed with food materials were evident from 2nd post operative day as seen in calf No.1	u control animal
II	Mandibular symphysiotomy	2	Active soon after operation and no complication marked except slight inflammation at mandibular region.	successful
		4	Apparently normal in the beginning. Refused to eat and drink slit like opening seen on 5th post-operative day followed by pneumonic symptoms.	unsuccessful
		6	Active and no complications marked.	successful
		8	Similar symptoms evident as in calf No.1 and 7.	control animal

Table VIII showing post-operative complications of cleft soft palate repair in experimental calves.

Complications	Group I				Group II			
	Calf Nos.				Calf Nos.			
	1	3	5	7	2	4	6	8
A. Pneumonia	+	+	+	+	-	+	-	+
B. Dysphagia	+	+	+	+	-	+	-	+
C. Post prandial nasal discharge	+	+	+	+	-	+	-	+
D. Dehiscence of soft palate	+	+	+	(*)	-	+	-	(*)
E. Oronasal fistula	+	+	+	+	-	+	-	+
F. Inflammation at mandibular region	-	-	-	-	+	-	-	-
G. Euthanatisation	-	-	-	-	+	-	+	-
H. Death	+	+	+	+	-	+	-	+

* = Control

\+ = Affected

\- = Not affected

Group No.	Type of approach	Calf No.	Pathological changes
I	Bilateral oral commissurotomy	1	Non-union of cleft. Lungs and respiratory passages showed pneumonic lesions, atelectasis and consolidation.
		3	As above
		5	As above
		7	Control animal. Similar changes as above
II	Mandibular symphysiotomy	2	Repaired cleft united. Nothing abnormal detected except non union of mandibular symphysis.
		4	Non union of cleft. Lungs and respiratory passage exhibited pneumonic lesions as in claf No.1
		6	Repaired cleft united. Other changes as in calf No.2 above.
		8	Control animal. Revealed similar changes as in calf No.1

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Fig. 1. Showing cleft in the soft palate

Fig. 2. Repairing of the clett in the soft palate by giving a single layer of continuous sutures .

Fg. 3. A median skin incision given in the intermandibular space in mandibular symphysiotomy technique.

Fig. 4 Drilling in the mandibular ramus with bone drill

Fig. 5. Closure of the intermandibular skin incrsion and immobilisation of the divided mandibular ran.i with stainle ss steel wire sutures passed through the drill ho'es ,

Fig. 6. Closure of the man.libular symphysiotomy incision in the lower jaw by longitudenal mattress suture .

Fig. 7. Section of soft palate showing healed up lesi ons by granulation tissues . H. E. ×. 25 .

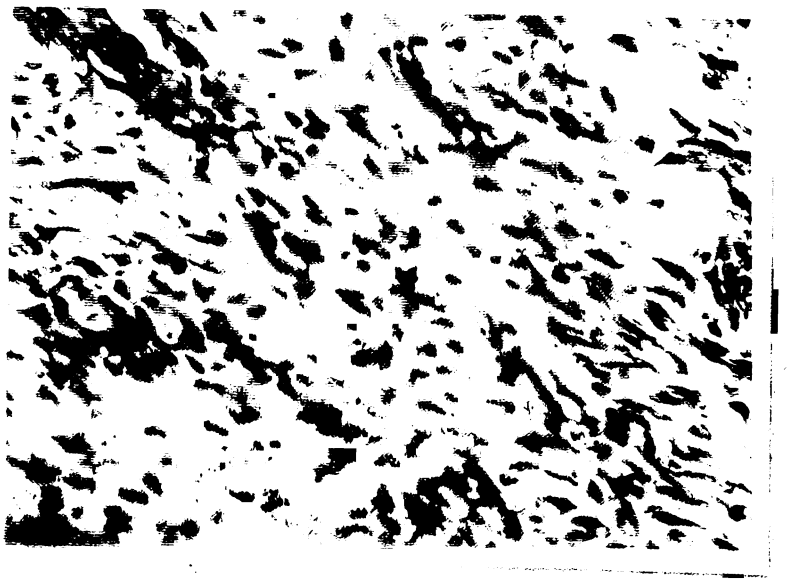

Fig. 8. Same as above H, E. × 128

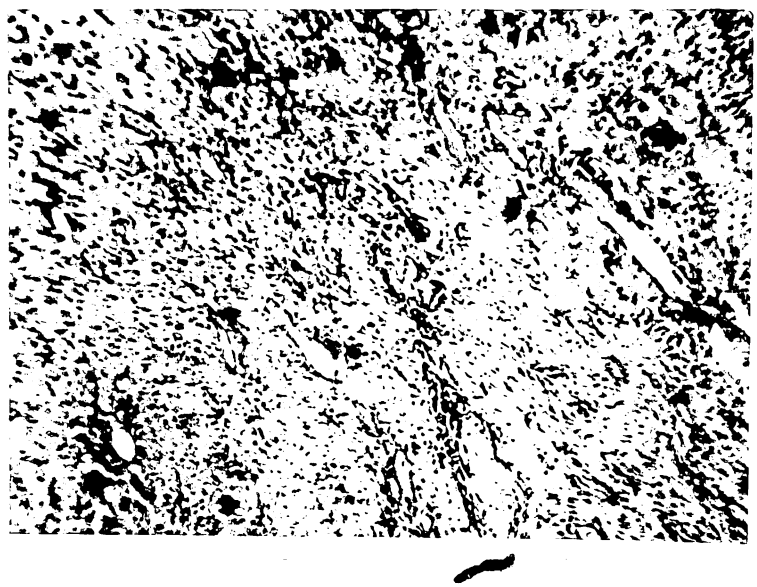

Fig. 7. Section of soft palate showing healed up lesi ons by granulation tissues . H. E. ×. 25 .

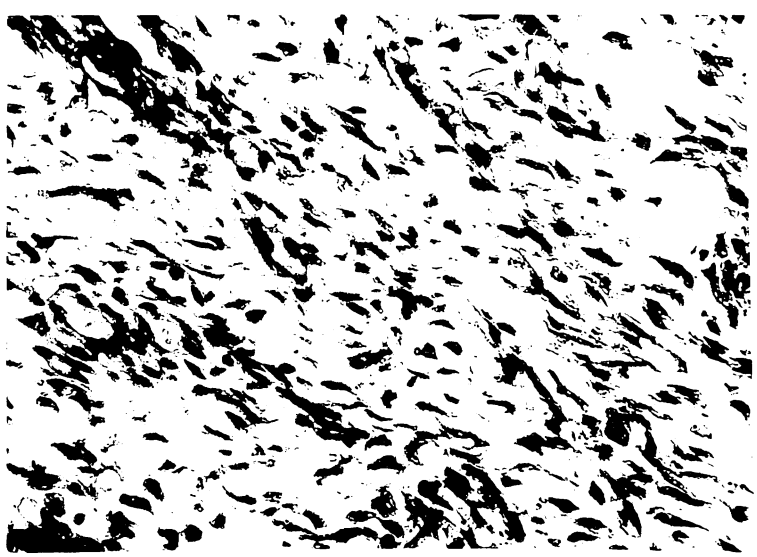

Fig. 8. Same as above H. E. × 128