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ANAESTHESIA OF RECENT INJURIES OF THE JAW AND FACE

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Suffocation is the chief cause of death in a maxillofacial casualty, which survives the initial injury. A large proportion of deaths occurs at the beginning or end of the initial anaesthetic. These deaths are for the most part preventable and should not occur if the elementary principles of anaesthesia of a maxillofacial casualty are known and understood.

The essentials are: quiet rapid induction of anaesthesia followed by pharyngeal toilet, prompt intubation, and packing off of the air passage from the site of operation. Recovery from anaesthesia should be rapid, without respiratory obstruction or inhalation of foreign material into the bronchial tree.

Patey and Riches (1) advocate tracheotomy under local anaesthesia and continuation with inhalation anaesthesia via the tracheotomy tube. This technique is of value in selected cases but as a routine it has been found unnecessary. They rightly point out the hazards of induction of anaesthesia with a face mask. They unfairly condemn the induction of anaesthesia with intravenous anaesthetics and support their contention by quoting a case in which asphyxial symptoms were allowed to develop rapidly and the patient was saved only by a rapid "plunge tracheotomy."

Bennett (2) practised blind nasal intubation with topical anaesthesia in patients with Ludwig's angina, and this method has its uses in a few cases.

Haugen (3) said that in as many cases of jaw injuries as possible operation should be done under regional block but adds that cyclopropane is the nearest approach to the ideal in these cases.

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Other American writers are inclined to rely on local infiltration and regional block. Local infiltration is very valuable in the minor cases and for patients too seriously ill to stand a general anaesthetic.

For anaesthesia of maxillofacial and oral surgery, Bentel (4) recommended intubation under pentothal, tamponage and maintenance by nitrous oxide and oxygen with intermittent continuous pentothal. He stated in this way 2½ to 3 Gm. of pentothal may be given without ill effect. Kelsey Fry et al. (5) maintained that the ideal is general anaesthesia by the endotracheal route with the pharynx packed off.

Shackleton (6) and Hewer (7) recommended induction with a small dose of pentothal followed by inhalation of cyclopropane and oxygen or nitrous oxide, oxygen and ether, followed by tracheobronchial succion, intubation and tamponage. Anaesthesia is maintained by inhalation.

For “old” maxillofacial cases I (8) advocated 1.0 Gm. pentothal induction, oxygen and carbon dioxide to stimulate respiration, and blind intubation. Anaesthesia was maintained by oxygen and ether in closed circuit as cyclopropane was not available.

**Experience and Number of Anaesthésias**

This paper is based on the experience of almost three years' full time anaesthesia of wounds and injuries of the jaw and face.

The observations in this article are based on 450 anaesthésias,* of which 305 were primary ones. The average time interval for these 305 patients between wounding or injury and induction of anaesthesia was one and one-tenth days. The shortest was two hours and the longest two days. There were 72 patients who arrived late, or the operation was postponed over three days from the time of wounding for surgical reasons or for the manufacture of cast metal splints. In 73 cases re-operation was performed in this series. In addition, during the period of time under observation 320 operations were carried out under local infiltration anaesthesia combined with premedication.

**Types of Injury**

In 93 cases the injuries were caused by accidents, excluding accidental wounding by missiles. The remaining 357 were due to enemy action. The types of injury are tabulated in table 1. Table 2 shows the type of missile causing the injury.

**General Principles**

The employment of a face mask is impracticable as the surgeon is working on the face, and the head is draped in sterile towels. The anaesthetic apparatus, therefore, must be well out of the way of the field of operation. In recently wounded cases the use of a face mask is not permissible, even during induction, as the pressure of the mask

* For simplicity, in this paper each anesthetic administered is considered as a separate case.
## TABLE 1

<table>
<thead>
<tr>
<th>Fracture Site</th>
<th>Enemy Action</th>
<th>Accidents</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandibles only</td>
<td>142</td>
<td>42</td>
<td>184</td>
</tr>
<tr>
<td>Maxillae only</td>
<td>44</td>
<td>8</td>
<td>52</td>
</tr>
<tr>
<td>Mandible and maxillae combined</td>
<td>32</td>
<td>2</td>
<td>34</td>
</tr>
<tr>
<td>Malars</td>
<td>9</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Maxillae and malars combined</td>
<td>9</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Mandibles, maxillae and malars</td>
<td>8</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Noses</td>
<td>—</td>
<td></td>
<td>—</td>
</tr>
<tr>
<td>Miscellaneous (soft tissues, eyes, necks, etc.)</td>
<td>113</td>
<td>18</td>
<td>131</td>
</tr>
<tr>
<td>Totals</td>
<td>357</td>
<td>93</td>
<td>450</td>
</tr>
</tbody>
</table>

## TABLE 1(a)

### Associated Injuries

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limbs</td>
<td>73</td>
</tr>
<tr>
<td>Chest</td>
<td>13</td>
</tr>
<tr>
<td>Abdomen</td>
<td>1</td>
</tr>
<tr>
<td>Head</td>
<td>22</td>
</tr>
<tr>
<td>Eyes</td>
<td>42</td>
</tr>
<tr>
<td>Multiple</td>
<td>2</td>
</tr>
<tr>
<td>Neck</td>
<td>29</td>
</tr>
<tr>
<td>Palate</td>
<td>34</td>
</tr>
<tr>
<td>Tonsil</td>
<td>4</td>
</tr>
<tr>
<td>Pharynx</td>
<td>12</td>
</tr>
<tr>
<td>Tongue</td>
<td>21</td>
</tr>
<tr>
<td>Hyoid</td>
<td>4</td>
</tr>
<tr>
<td>Thyroid cartilage</td>
<td>1</td>
</tr>
<tr>
<td>Epiglottis</td>
<td>2</td>
</tr>
</tbody>
</table>

## TABLE 2

### Types of Missile

- Gun shot wounds: 182
- Mortar, mine and bomb wounds: 69
- Shell wounds: 106

| Total | 357 |

may start off an intra-oral haemorrhage by moving the jaw fragments, and blood and debris may be aspirated. Induction must be by other than inhalation to minimise the risk of haemorrhage, and a perfectly clear airway must be maintained during this time to ensure no sucking of blood or other foreign material into the bronchial tree by a partially obstructed inspiration. Anaesthesia must be by intubation as a good airway must be maintained during anaesthesia. Maintenance should be smooth at the lightest possible level of anaesthesia with adequate protection against inhalational hazards.

At the end of the operation there should be an active cough reflex and recovery of consciousness should be rapid to enable voluntary control of the tongue and secretions to be recovered quickly. Until recovery of consciousness a perfectly clear airway must be maintained.

### Preparation

Insofar as all the patients were recent battle casualties or accidents, little preparation for operation was possible. The patients were not given food or drinks until it had been decided whether or not an
operation was to be performed. In quite a number of cases there were blood clot and saliva in the mouth and pharynx. This material was removed by swabbing out the mouth and pharynx with small swabs on a Magill's forceps under direct vision with a laryngoscope. In this way there was less chance of respiratory obstruction during induction, and of inhalation of blood and debris before intubation and tamponage. The nose and throat were sprayed with 10 per cent cocaine hydrochloride previous to induction when this procedure was not contra-indicated.

Resuscitation

In most cases the patients had been adequately resuscitated by the Blood Transfusion Units when it had been necessary. Nearly all arrived in good condition.

In 11 cases it was necessary to administer blood before the patient was fit for operation. In 1 case it was given because of a massive secondary haemorrhage. In 3 cases blood or plasma was administered soon after the start of anaesthesia. In 12 cases blood (or plasma when blood was not available) was given during operation due to deterioration from length of operation, or haemorrhage. In 1 case a condition similar to shock developed and the patient responded to 2 cc. anacardone without intravenous therapy.

Apparatus

For almost all inhalational anaesthetics, circle carbon dioxide absorption technique was employed. Other forms of apparatus were employed only when the circle absorber was already in use elsewhere. Thus the to-and-fro carbon dioxide absorption technique of Waters was used on 39 occasions; the semiclosed technique without absorption on 4 occasions, and the Oxford vapourizer 4 times.

Premedication

Premedicants were omnopon, grain ¼, with scopolamine, grain ¼\textsubscript{50}. This combination was given subcutaneously one to one and a half hours before operation, or if this was not practicable it was given intravenously as long as possible before induction of anaesthesia. If morphine had been administered within the last six hours the omnopon was omitted and atropine, grain ¼\textsubscript{50}, was given. It was injected intravenously if necessary.

Cocainisation

Thoroughly spraying the larynx with cocaine solution was a very important part of this technique—it decreased greatly the incidence of laryngeal spasm and facilitated intubation; it minimised the disturbances set up by intubation under light anaesthesia. In cases in which spraying would have necessarily involved an open wound, it was dispensed with as it was thought that the danger of toxic effects would be
too great. Cocainisation of the nose facilitated the passage, without trauma, of a larger size of endotracheal tube than would otherwise have been possible. About 90 per cent of the patients undergoing an inhalation anaesthesia werecocainised with 10 per cent cocaine.

**Induction**

Anaesthesia was induced on an operating table to facilitate the adoption of a 10 degree Trendelenburg position whenever necessary. Induction was always by pentothal (5 per cent) which was given very slowly intravenously, so as to avoid causing respiratory arrest. Meanwhile, a perfect airway was assured by pushing the patient’s vertex toward his feet. If necessary, an airway or nasopharyngeal tube was inserted. Occasionally the use of a laryngoscope was necessary to ensure this. As much pentothal as possible (up to a limit of 1 Gm.) was injected, making sure that respiratory arrest did not occur. The usual dose reached varied between 0.25 Gm. and 0.75 Gm. and was usually around 0.75 Gm.

The pillow was removed, and a Denhardt’s self-retaining gag was inserted between the molars. Direct vision laryngoscopy was performed and, after pharyngeal toilet had been done, an endotracheal tube was passed. The latter was connected to the anaesthetic machine and anaesthesia was continued by inhalation. The air passages were closed off from the mouth and nasopharynx by packing the throat with a vaseline gauze pack.

The soda lime canister was then introduced into the circuit and the oxygen flow reduced to basal.

**Maintenance**

A very light level of anaesthesia was maintained (upper plane 1 of the third stage [Guedel]), but it was deepened temporarily if the patients coughed.

At the end of the operation the mouth was swabbed clear, the pack was removed and the pharynx examined with a laryngoscope for blood and debris in case any had inadvertently passed the pack. Any found was swabbed out by employing the laryngoscope and small swabs held in Magill’s forceps.

**Recovery**

After pharyngeal toilet, the patient was turned on his side and stabilised by flexing his under knee. The pillow was again removed and the foot of the stretcher or bed was elevated to ensure that the mouth was lower than the trachea, so that there was no aspiration of blood or debris during recovery. In most cases the endotracheal tube was removed and replaced by one or two nasopharyngeal tubes. The patient recovered under the supervision of the anaesthetist. This was achieved either by keeping the patient in the theatre precincts until he
had regained consciousness or by having the wards next door to the theatre.

The endotracheal tube was left in position until consciousness was recovered in cases in which nasal respiration was not possible or when it was thought that an ordinary Waters pharyngeal airway (when it was possible to use one) or nasopharyngeal tubes would not control the airway. In 14 cases it was considered necessary to leave the endotracheal tube in situ. Thus, in 4 cases the endotracheal tube was left in place until consciousness was regained because the tight crepe bandage which was being used would have caused respiratory obstruction without an endotracheal tube. In 2 cases the endotracheal tube had to be replaced. One patient kept attempting to inhale his epiglottis and the other was obstructed by two large septic tonsils meeting in the mid line. In 2 other cases it was left in place because old fractures of the nose had caused difficulty in intubation and had re-intubation been necessary it would have been difficult to perform. In 3 cases it was left in place because of oedema and swelling around the laryngeal aditus, in 2 cases because of the danger of haemorrhage during recovery and in one case because there was intermaxillary fixation (i.e., the jaws were wired or splinted together).

Postoperative Sedation

Morphine was discouraged after operation as it is considered dangerous after anaesthesia in cases with intermaxillary fixation. It was seldom necessary on account of pain, and the patients had no difficulty in sleeping as they had been travelling many hours previous to operation. The danger of morphia is illustrated by the following case history (not in this series).

Case 1.—P./O. McF., aged 30, had a ninety-two minute anaesthesia for removal of sequestra from a fractured mandible. Premedication was omnopon, grain ½, with scopolamine, grain ½ m. The anaesthetic consisted of 1.0 Gm. pentothal and 3 ounces of ether administered by a No. 9 nasal endotracheal tube with closed carbon dioxide absorption technique. He had intermaxillary fixation. He was sent back to the ward at 1900 hours with two nasopharyngeal tubes. He had a good colour and a clear airway. He recovered consciousness and had a drink. At 0100 hours he was given morphia, grain ¼, subcutaneously either because he had pain or could not sleep. At 0400 hours another patient noticed that he was "snoring heavily." At 0430 hours the anaesthetist was called. On examination the patient was cyanosed with stertorus and see-saw respiration. He could not be roused. Pulse was 140 and of fair volume. An attempt was made to relieve the respiratory obstruction by pushing the jaw forward but, owing to the intermaxillary fixation, this was of no avail. Nasopharyngeal tubes were inserted which considerably relieved his obstruction. Oxygen was administered by one nasopharyngeal tube and this resulted in an immediate improvement in colour. His nasopharynx was sucked out via a nasopharyngeal tube and oxygen was left running for two hours. At 0800 hours the nasopharyngeal tubes were removed and he could be roused although he
was very drowsy. There seems no doubt that this patient would have died of asphyxia on account of the administration of the morphia had a fellow patient not raised the alarm.

ROLE OF LOCAL ANAESTHESIA

In a great number of cases the procedure can be done with local anaesthesia, with or without additional premedication. This is possible when the procedure does not involve bone. It has several advantages in that there is much less risk to the patient and less work for the nursing staff. In the period under consideration, 320 operations were done under local anaesthesia combined with premedication, the 1 per cent novutox being infiltrated by the surgeon himself. It was also used for patients too ill to stand general anaesthesia.

RELATIVE CONTRAINDICATIONS OF ANAESTHESIA

We worked on the principle that if the anaesthesia or operative procedure was likely to lead to the early demise of the patient, it was better to do what was possible under local anaesthesia and premedication rather than subject a patient, who was on the borderline, to a full intubation anaesthetic and a prolonged operation as it would necessarily be. This referred especially to closed head injuries. If, in a few days' time the patient was still alive, he would be in a fitter condition to stand the operative procedure. Blast injuries of the chest were treated with great respect; general anaesthesia was avoided whenever possible and the operation performed under local anaesthesia (vide also history of case 11).

PROBLEMS ASSOCIATED WITH SPECIAL WOUNDS. INDUCTION OF ANAESTHESIA WITH INTRA-ORAL HÆMORRHAGE

Usually when there had been haemorrhage into the mouth it had stopped by the time the patient arrived on the table. In this case all that was found necessary was to mop out the pharynx and mouth with small swabs on Magill's forceps with the aid of the laryngoscope; gentle mopping with swabs was much more satisfactory than suction. When the mouth and pharynx were clear, the patient was placed in a 5 to 10 degree Trendelenburg position and anaesthesia induced. In some 13 cases this was necessary and bleeding did not occur during laryngoscopy. During laryngoscopy there is the hazard of either moving the fractured bones and starting a haemorrhage, or of dislodging a clot in the soft tissues or from the tooth sockets. It is for this reason that the use of a face mask is strongly condemned during induction; should a haemorrhage start whilst the mask is on, the patient would almost drown in his own blood before the anaesthetist was aware of it.

In 2 cases haemorrhage occurred into the mouth during laryngoscopy. One patient had a small haemorrhage; he was tipped head down and it stopped quickly. The other case was most alarming.
Blood poured into the mouth, the haemorrhage was controlled by digital pressure by the surgeon and, after mopping and sucking out the blood, intubation and packing was completed. The source of haemorrhage was temporarily packed until it was dealt with by surgical means.

One other case is of interest.

Case 2.—Lieut. R., aged 22, was admitted a few hours after a motorcycle accident with a severely fractured mandible. He was bleeding into the mouth and it was impossible to control the haemorrhage, even temporarily, by mopping. Blind intubation while he was conscious failed. However, on cutting the bandage around the jaw, the haemorrhage ceased; so after mopping out the mouth again the normal technique was used. The bandage had caused venous congestion and its removal allowed the haemorrhage to occur extra-oroally instead of intra-oroally.

**Intubation without Anaesthesia**

This is described by Bennett (2) for Ludwig’s angina. In the three cases here described topical anaesthesia was not used, and tubes with inflatable cuffs were employed instead. This is well worth trying in patients who are unconscious and in patients in whom, from previous experience, it is known that direct vision laryngoscopy will be hazardous and difficult. The following cases will illustrate these points.

Case 3.—St. Str. M., aged 24, of the Polish Army, was involved in an M. T. accident. His face was thrown with force against the windscreen, giving him a bilateral fracture of maxilla and mandible. On admission, his face was swollen, he was cyanosed, and was breathing with great difficulty—being three parts obstructed. His life had already been saved by the passage of a large nasopharyngeal tube through one nostril. He was unconscious. While the surgeon was “scrubbing up” to perform a tracheotomy, the anaesthetist was able to pass blindly a No. 9 Magill’s tube, with an inflatable cuff, through the nose. A great deal of blood and mucus was coughed out of the tube and in a minute or two his colour had greatly improved and respiration quietened down. The cuff was inflated, anaesthesia was induced with cyclopropane and pharyngeal toilet and tamponage performed. Tracheotomy was performed at the end of the operation to ensure a good airway. Some six days later he died from a torrential haemorrhage from the erosion by the tracheotomy tube of one of the great vessels in his neck.

Case 4.—Capt. L., aged 29, of the Polish Army, was wounded sixteen hours previously. He was in an observation post when he was struck in the face by a shell fragment. This shattered both maxillae and caused a compound fracture of his mandible. The palate was destroyed and his tongue was lacerated. When he arrived his condition was serious, his pulse was 108, and blood pressure 108 mm. systolic and 68 mm. diastolic. Resuscitation with blood and plasma was undertaken before operation was considered advisable. He was taken to the anaesthetic room where resuscitation was continued. Omnopon, grain $\frac{1}{3}$, with scopolamine, grain $\frac{1}{450}$, was given intravenously and he lay comfortably on his abdomen with his head supported by an assistant. In due course he went to sleep as the premedication took effect. As his respiration had become more and more stertorous, he was watched with anxiety. Suddenly respiration became completely obstructed and he became extremely restless, pulled his blood drip
out, and could hardly be held on the stretcher. Laryngoscopy was immediately performed, with difficulty, because of distortion of the tissue, and blood, and the vocal cords were found to be in partial spasm. He was intubated with a No. 8 cuffed Magill's tube and given controlled respiration with oxygen, to which he responded. He was taken to the theatre where anaesthesia was maintained with cyclopropane and oxygen. His pharynx was not packed off so as to facilitate the work of the surgeon. A tracheotomy was done at the end of operation to ensure his airway. At operation his blood pressure reached 132 mm. systolic and 72 mm. diastolic and it was 160 mm. systolic and 80 mm. diastolic at the end of an operation of two hours and fifteen minutes' duration, by which time he had received 3 pints of stored blood. At the end of operation his trachea was sucked out by the passage of a catheter to clear any blood which might have entered his bronchial tree. He was very restless on recovery and had a very active cough reflex. This had to be controlled by omnopon, grain $\frac{1}{2}$, intravenously.

Case 5.—Pte. F. was sleeping in the back of a 15 cwt. truck when it touched another vehicle coming from the opposite direction. The accident was thought to be so trivial by the driver that he did not stop. The patient was found at the end of the journey to be lying in a pool of blood, unconscious and with his jaw and skull fractured. In spite of the latter it was decided that fixation of his mandible was essential. For this general anaesthesia was necessary as he was too restless for the operation to be done under "local." He was unconscious and a No. 8 cuffed Magill's tube was passed blindly through the left nostril without anaesthesia, and anaesthesia was uneventfully continued with cyclopropane.

This technique was unsuccessfully attempted in a fourth case (Case 2).

VOMITING DURING INDUCTION AND RECOVERY

In three cases vomiting occurred during induction. In one case this was due to passive regurgitation under the pentothal and in the other two it occurred just after intubation. Two patients vomited at the end of operation and one of these gave rise to anxiety. He (Case 2) vomited spaghetti while the surgeon was cleaning up the face. The vomitus was extruded from the nostril—the pack being still in situ. The "head down" position was adopted and the pack quickly removed. Some vomitus was aspirated and was coughed out of the endotracheal tube. After consultation with the ear, nose and throat surgeon, it was decided that, as the patient had been under anaesthesia for three hours and as he had a severe fracture of the mandible, it was not justifiable to do a bronchoscopy. He had an active cough reflex and bronchial suction was performed with a rubber catheter. The right lung was a little moist on auscultation and the air entry was fairly good. A roentgenogram was made the next day and there was no evidence of collapse. Subsequent recovery was uneventful.

It was not possible carefully to follow up the cases of postoperative vomiting on account of the pressure of work. With the exception of Case 2, no other case caused anxiety from postanaesthetic vomiting.
LARYNGEAL WOUNDS

In 4 cases the hyoid bone was fractured and in 1 case the thyroid cartilage was fractured. In two pharyngeal wounds the epiglottis was lacerated and in both cases small attached pieces were flapping in and out of the larynx with each breath taken. The pieces were removed by the anaesthetist and at the end of operation tracheotomy was done in each case. Cuffed tubes were used in these cases.

TONGUE WOUNDS

The tongue was involved on 21 occasions in this series. Besides being a source of intra-oral haemorrhage, a badly lacerated tongue may give rise to difficulty in intubation by sliding into the lumen of the laryngoscope. As long as the tongue is swollen owing to haematoma formation or infection, it is dangerous to splint the teeth together as there is not enough room in the buccal cavity to contain the tongue, with the result that it is forced backwards, giving rise to respiratory obstruction.

TRACHEOTOMY

On 11 occasions the anaesthetic had to be administered by way of a tracheotomy tube. In the early days when cyclopropane was in short supply, chloroform was used in a circle closed circuit as the anaesthetic for maintenance, since it was thought inadvisable to use ether in view of the “normal” tracheitis. The inner tracheotomy tube had its flanges bent vertically, and was connected by a small piece of wide bore rubber tubing to a vulcanite L-shaped Rowbotham’s connection with a rubber cork to permit tracheobronchial suction. This was connected to the anaesthetic machine and oxygen was administered. Vaseline gauze was packed around the tracheotomy opening to make it gas tight. Pentothal, 0.5 Gm. was used for induction and anaesthesia was continued with cyclopropane and oxygen in a circle closed circuit.

On 4 occasions a tracheotomy was done at the end of the operation to ensure a good airway. There were no cases of emergency “crash” tracheotomies or laryngotomies.

SYMPHYSIS

In wounds of the symphysis menti region, direct vision laryngoscopy is usually facilitated by the absence of the incisor teeth. During induction with pentothal it is necessary to insert an airway or nasopharyngeal tube as respiratory obstruction nearly always occurs. This is caused by damage to, or loss of, the anterior attachment of the musculature of the tongue to the genial tubercles. For the same reason, special care should be taken postoperatively as respiratory obstruction is very likely to occur. Here a tongue stitch is a very wise prophylactic measure.
The following case history illustrates the danger of obstruction during induction of a patient with a symphysis wound and the hazards of administering pentothal alone in a severe maxillofacial injury. This case is not in this series and the anaesthetic was not given by the author of this article.

Case 6.—Sgt. McN. was struck by a mortar fragment in the symphysis region and the mandible was shattered from $\frac{5}{8}$ to $\frac{3}{8}$ region. There was a loss of the soft tissues of the lip and chin, with separation of the tongue from genial attachments. He was treated for shock and haemorrhage at a Casualty Clearing Station and was evacuated to the hospital. He was anaesthetised with pentothal. After five minutes of stertorous breathing at the commencement of surgical toilet, respiration ceased. Only then was an endotracheal tube passed; intracardiac adrenalin was administered, but he did not recover.

Provided it is recognised that respiratory obstruction occurs to a greater or lesser degree as soon as voluntary control of the tongue is lost, patients with this type of wound will not become asphyxiated if the airway is secured by a pharyngeal airway or by nasopharyngeal tubes. If a pharyngeal airway or nasopharyngeal tubes do not provide a good airway, the use of a laryngoscope to expose the larynx will always ensure a perfect airway.

Maxilla and Nasal Cavity

In cases in which the wound involved the maxillae or nasal cavity, intubation was of necessity done through the mouth. Examination of roentgenograms in cases of wounds of the upper part of the face often revealed that the missile had traversed the nasal cavity. This contraindicated the use of a nasal tube on account of the danger of haemorrhage or of filling the endotracheal tube with blood clot. Occasionally it was a surgical necessity to intubate nasally when there were floating maxillae, and the operation was one of intermaxillary fixation. In this case, after very efficient cocainisation, it was usually possible to introduce an endotracheal tube gently through the nose, though occasionally it had to be as small as No. 4 or 3. This was usually necessary in a case which was not "fresh." In recently injured cases with full dentition in which nasal respiration was poor or impossible, fixation of the jaws by eyelet wires or splints was postponed for some days because of the great danger of asphyxia. Intermaxillary fixation is permissible only when nasal respiration is possible.

Palatine Wounds

On 34 occasions the palate was involved by the passage of the missile. These wounds were very likely to be missed as dried blood clot sticking to the roof of the mouth obscured the picture. If this occurred it was usually discovered during induction as, all things being equal, the patient went to sleep with much less pentothal than normally. In
these cases intubation was necessarily oral. If the laceration of the palate extended far back it was best to use a cuffed tube as a pack would be in the way of the surgeon when he was sewing up or exploring this region. Very occasionally when the laceration of the palate was anterior and was confined to one side, a nasal tube was passed through the other nostril. Great care must be taken with some of these cases as, if the direction of the missile is upward, there is liable to be a fractured anterior cranial fossa. This type of wound was found to be very lethal when combined with a closed cranial lesion (Case 9).

**INTERMAXILLARY FIXATION**

Splinting the jaws by wiring the teeth together, or wiring or locking together the splints which have been cemented onto the teeth, is the rule rather than the exception in injuries to the jaw. The pack was removed at the end of the operation, and pharyngeal toilet performed. Intermaxillary fixation was then done and the patient was turned on his side with his head down. In some cases it was found that there was still a slight haemorrhage from the fracture site or tooth socket. The haemorrhage was controlled by continuous aspiration while the tie wires were being tied. It was usually found that the haemorrhage stopped when reduction was carried out. In any case the usual precautions were taken during the recovery period. When there was haemorrhage into the mouth or difficulty in breathing through the nose or any other hazard, intermaxillary fixation was postponed until consciousness was regained. There were at least 89 cases in which intermaxillary fixation was done at the end of the operation. Included in this figure are 5 cases in which the jaws were wired together throughout the operation.

The importance of the attention to detail in maintaining a clear airway at the end of anaesthesia until the recovery of consciousness is indicated in the following case history; this case is not in this series and the anaesthetist was given by an anaesthetist not acquainted with these problems.

**Case 7.—Pte. F., aged 25, was injured by a mortar bomb and sustained a double compound fracture of the mandible through the symphysis region.** He was anaesthetised uneventfully with pentothal, endotracheal gas, oxygen and ether. At the end of operation after intermaxillary fixation, the anaesthetist removed the endotracheal tube and the patient was not properly turned onto his side, nor were nasopharyngeal tubes inserted. He was taken back to a dark ward where, unnoticed, he quickly died of suffocation. Postmortem examination revealed only that the upper and lower genial tubercles were completely detached and the tongue had no anterior attachment.

There are certain hazards to intermaxillary fixation. It should not be done if there is a swollen tongue or if there is not a clear nasal airway, especially in the presence of a full dentition. The point is best illustrated by the following case, which is not included in this series.
Case 8.—Pte. J., aged 31, was accidentally hit across the face by the falling tailboard of a lorry. He was unconscious for ten minutes and bled from his nose and ears. On admission, he was found to have a fracture of the middle third of the maxilla, Guerin's type, and a fracture of the base of the skull. He was treated by plaster of Paris head cap and cast metal splints. Three days after injury, intermaxillary fixation was applied after reduction of the maxilla. Some hours later he said he was suffocating but this was treated lightly by the nursing staff. Later on that night he awoke complaining of suffocation and, by the time effective aid came, the jaws were unwired, and intubation and artificial respiration performed, he was dead. Necropsy revealed the fractured maxilla and fractured middle and anterior cranial fossae with early basal meningitis and a small dural tear in the cavernous sinus region.

At no time during his treatment was an anaesthetic or morphia administered. He died of suffocation owing to his having little or no nasal airway and to intermaxillary fixation in the presence of full dentition.

LARYNGEAL OEDema

Oedema or haemorrhage into the loose areolar tissues of the pharynx and larynx is very likely to occur in wounds of the neck. Oedema of the aryepiglottic fold and the nearby tissue was seen in 8 cases. In one, it was due to a tense haematoma of the neck and, in addition, the pharyngeal wall bulged into the "fairway." At the end of operation, which included the evacuation of the haematoma, the oedema was much diminished.

The epiglottis itself was chiefly involved in 3 cases and in 1 case was estimated to be three times its normal size. In 1 case the lateral pharyngeal wall bulged in just above the larynx but there was almost no oedema. In some cases this oedema caused difficulty in viewing the larynx on laryngoscopy, but on no occasion was there respiratory distress before operation. In no case was it considered necessary to do a tracheotomy and the precaution of leaving the endotracheal tube in situ until consciousness was regained was observed in the more severe cases.

Pharyngeal Toilet

By this term is meant the mopping out of the oropharynx, laryngopharynx and nasopharynx with small swabs (1 inch by ½ inch) held on a Magill's forceps under direct vision. In this way blood, mucus and debris generally are removed and their aspiration prevented. It should be performed before anaesthesia if there has been much haemorrhage into the mouth. Normally, it is done after induction with pentothal before the endotracheal tube is passed. It is done again at the end of operation both before and after removal of the pack. On three occasions blood was seen in the trachea on laryngoscopy but tracheobronchial suction was performed only if the airway was not clear, as the cough reflex in other cases would remove any blood or debris from the trachea.
INTUBATION

Intubation was always by direct vision for primary operations except in 3 cases in which blind intubation was carried out without anaesthesia. Blind intubation was used for secondary operations when the pharynx was known to be clear, or when it was requested by the dental surgeon, so that movement of the fracture would not be produced by laryngoscopy. In 87.7 per cent intubation was performed by direct vision and in 12.3 per cent blind intubation was carried out. In 94 cases oral intubation was required, usually in cases in which the wound involved the maxilla, nose or palate. In table 3 will be seen the sizes

<table>
<thead>
<tr>
<th>Size of Tube</th>
<th>Number of Times Used</th>
<th>Per cent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>65</td>
<td>18.2</td>
</tr>
<tr>
<td>9</td>
<td>239</td>
<td>66.9</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>4.2</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>with infl.</td>
<td>14</td>
<td>—</td>
</tr>
<tr>
<td>cuff</td>
<td>11</td>
<td>8.4</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>357</td>
<td></td>
</tr>
</tbody>
</table>

of tubes used; the No. 10 was used for oral intubations; the size 3 was used in a child of 7 who was injured by a mine explosion.

For the nasal intubations, the right nostril was used 154 times, and the left 90 times. On 19 occasions no record was made. The high incidence of use of the right nostril was probably the result of habit as the anaesthetist is right-handed. The endotracheal tubes were smeared with 1 per cent mupercaine ointment and lubricated with liquid paraffin.

<table>
<thead>
<tr>
<th>Method</th>
<th>No.</th>
<th>Per cent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct vision</td>
<td>313</td>
<td>87.7</td>
</tr>
<tr>
<td>Blind</td>
<td>44</td>
<td>12.3</td>
</tr>
<tr>
<td>Total</td>
<td>357</td>
<td>100.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>94</td>
</tr>
<tr>
<td>Nasal left nostril</td>
<td>154</td>
</tr>
<tr>
<td>Nasal right nostril</td>
<td>90</td>
</tr>
<tr>
<td>Nasal not recorded</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>357</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaesthesia via tracheotomy</td>
<td>11</td>
</tr>
<tr>
<td>Tracheotomies at end of operation</td>
<td>4</td>
</tr>
</tbody>
</table>
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TAMPONAGE OF THE PHARYNX

It is the anaesthetist’s responsibility to guard against the inhalation of blood or other foreign material. Only by careful attention to detail in the packing off of the pharynx can the aspiration hazard be eliminated. After pharyngeal toilet and intubation, the pharynx was packed off by 3 or 4 feet of 4 inch vaseline gauze in the case of nasal intubations; for oral intubations two 2 inch packs were inserted on either side of the endotracheal tube. The pharynx was packed firmly and, if anything, too much rather than too little packing was used. At the end of the operation the mouth was mopped clear of blood and debris, the packs removed and pharyngeal toilet carried out if it was necessary. Intermaxillary fixation was performed and the patient turned onto his side.

ANAESTHETIC AGENTS

Pentothal anaesthesia was used alone for the more minor operations (in which the inhalation hazard, for practical purposes, did not

| TABLE 5 |
| TABLE OF ANAESTHETIC AGENTS |
|---------------------------|-----------------|---------|
| Agents                     | Number Given     | Per cent of Total |
| Pentothal only             | 78              | 17.3    |
| Pentothal, oxygen and ether| 302             |          |
| Pentothal, air and ether   | 306             | 68.0    |
| Pentothal, oxygen and chloroform | 6 | 1.3 |
| Pentothal, gas and oxygen  | 1               |         |
| Pentothal, cyclopropane and oxygen | 52 | 12.0 |
| Cyclopropane and oxygen    | 2               |         |
| Gas, oxygen and chloroform | 1               |         |
| Pre-medication and local   | 4               | 0.9     |
| Total                      | 450             |         |

exist), such as removal of a superficial foreign body from the cheek. About 17 per cent of the anaesthetics administered were pentothal alone. In one case, it was discovered that the track of the missile communicated with the oral cavity, so the surgeon was asked to wait while intubation and tamponage were effected. Pentothal was used for induction in 81.1 per cent of cases. The great advantage of pentothal induction is that it is quiet and does not increase the blood pressure, so the tendency to bleed during this difficult and hazardous phase is minimised. In 19 cases (4.3 per cent) laryngeal spasm occurred during induction. Laryngoscopy was done and pharyngeal toilet performed to remove any reflex cause of laryngeal spasm. When it persisted, or cyanosis occurred, oxygen with 10 per cent carbon dioxide was blown into the mouth and as soon as possible the patient was intubated orally with a No. 6 Magill tube. Anaesthesia was deepened by cyclopropane
and oxygen and when the cords were relaxed the tube was changed for the normal size.

Cyclopropane is the ideal agent for maintenance because of the rapid recovery. Unfortunately, it was not in good supply until some time after the battle of Cassino when it was used for 95 per cent of inhalation anaesthetics. Earlier it was kept for selected cases. The only disadvantage is the increased bleeding which occurs in the wound and local anaesthesia combined with epinephrine was used during anaesthesia for haemostasis. No ill effects were observed with the use of the epinephrine during cyclopropane anaesthesia.

Ether in closed circuit was used most often for maintenance but normally only 1 or 2 ounces was required.

Chloroform was used when inhalation anaesthesia had to be given by a tracheotomy tube, on account of its nonirritating properties, when cyclopropane had to be conserved.

Respiratory Complications

Table 6 shows the incidence of respiratory complications. On admission, 7 patients already had lower respiratory infection, which was

<table>
<thead>
<tr>
<th>TABLE 6</th>
<th>Respiratory Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative lower respiratory infection (probably tracheobronchitis)</td>
<td>7</td>
</tr>
<tr>
<td>*Postanaesthetic tracheobronchitis</td>
<td>1</td>
</tr>
<tr>
<td>†Bronchopneumonia</td>
<td>2</td>
</tr>
</tbody>
</table>

* Excluding patients with tracheotomies.
† One case followed on a condition of “blast lung.” The other case followed a preoperative lower respiratory infection.

probably tracheobronchitis. With one exception (Case 12), the infection cleared up postoperatively. One patient with chronic nasal sinus infection developed tracheobronchitis postoperatively, which cleared up without further complications. The figures do not include patients with tracheotomies in which a slight tracheobronchitis “normally” occurs.

Two patients died of bronchopneumonia. One patient (Case 11) was found at necropsy to have a condition of blast lung which must have been a major factor in his demise. The other patient (Case 12) who died of bronchopneumonia coughed thin yellow pus out of the endotracheal tube on intubation. In addition, his extensive chin wound broke down and poured pus and this must have been a contributing factor to his death.

Deaths

In this series of cases there were 8 deaths. One patient was admitted moribund and died of gas gangrene of the face. Another with
a G.S.W. mandible and chest and spine died of bronchopneumonia and paraplegia. He was not subjected to a general anaesthetic. A third had a secondary haemorrhage from a great vessel in his neck which was eroded by a tracheotomy tube. The other 5 cases are reported in more detail as they are of interest from the anaesthetic point of view.

There was one death under anaesthesia.

**TABLE 7**

**Deaths**

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Injury</th>
<th>Day of Death</th>
<th>Cause of Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Penetrating wounds of face, head and legs</td>
<td>3</td>
<td>Gas gangrene temporal muscles and infected blood clot temporal lobe</td>
</tr>
<tr>
<td>14</td>
<td>G.S.W. mandible, chest and spine—paraplegia</td>
<td>15</td>
<td>Bronchopneumonia and multiple injuries</td>
</tr>
<tr>
<td>3</td>
<td>Compound fracture mandible and maxilla, patella and other injuries</td>
<td>7</td>
<td>Secondary haemorrhage from carotid artery</td>
</tr>
<tr>
<td>9</td>
<td>Shell wound face, maxilla, palate and mandible</td>
<td>1</td>
<td>Cardiac failure. Fractured skull and multiple injuries</td>
</tr>
<tr>
<td>10</td>
<td>Shell wound maxilla, mandible, thyroid cartilage and brachial plexus</td>
<td>7</td>
<td>Secondary haemorrhage—asperiration of blood into lungs</td>
</tr>
<tr>
<td>5</td>
<td>Fracture of mandible and skull; lacerated tongue</td>
<td>2</td>
<td>Fractured base of skull, fractured mandible and C.S.F. rhinorrhoea</td>
</tr>
<tr>
<td>11</td>
<td>Shell wound mandible, &quot;blast lung&quot; and multiple injuries</td>
<td>5</td>
<td>Blast lung and bronchopneumonia</td>
</tr>
<tr>
<td>12</td>
<td>G.S.W. symphysis menti</td>
<td>15</td>
<td>Cardiac failure. Bronchopneumonia. Sepsis</td>
</tr>
</tbody>
</table>

**Case 9.—**Pte. J. was admitted on the day he sustained a shell wound of the face. The fragment probably entered by a right suborbital wound and passed downward. It destroyed his right eye and shattered his maxilla, lacerated his palate and tongue and carried away the left horizontal ramus of his mandible. It was noticed that he was restless before anaesthesia, but no special importance was attached to this at the time. At 2300 hours anaesthesia was induced with 0.5 Gm. of pentothal. This was given slowly, but he stopped breathing. Laryngoscopy and pharyngeal toilet were done according to custom. Laryngoscopy was difficult owing to the damage to the palate. Intubation was difficult because of laryngeal spasm. On intubation the absence of carotid pulsation was noticed and the surgeon, who had left the room, was sent for. The lungs were rhythmically inflated with oxygen and carbon dioxide and cardiac massage was started through the diaphragm nine minutes after the induction of anaesthesia;
1 cc. of epinephrine was injected into the heart through the diaphragm. After four minutes the heart started at 156 beats to the minute. Nine minutes after the heart began beating, he started gasping and one minute later he was breathing more or less normally. Thirty-three minutes after induction of anaesthesia, the cuff on the endotracheal tube was inflated. Respirations at this time were very deep and were 24 to the minute, though the circle absorber had been introduced into the circuit four minutes before. The operation was continued without any anaesthetic. At this time pulse was around 152 and blood pressure between 70 and 80 systolic and 30 and 45 diastolic. In due course the anaesthetic machine was disconnected and he was turned on his side, with his head down, but the endotracheal tube was left in situ. Three hours after the induction of anaesthesia the pulse had risen to 180 and respiration to 56. An hour and a half later his respiration, which had been Cheyne-Stokes in character, became fast and shallow, and he began to have generalised tonic convulsions of all four limbs. He died at 0800 hours, nine hours after his original cardiac failure. Necropsy showed old adhesions and haemorrhages into bases of both lungs; some blood stained mucus in his trachea; heart was normal but there were some petechiae at the base of the interventricular septum (probably due to the injection of epinephrine). The brain showed bruising of the right and left frontal lobes and left temporal lobe. There was a comminuted fissure fracture of the anterior cranial fossa running from the roof of the right orbit across and back to the root of the left lesser wing of the sphenoid, with comminution of the ecribriform plate.

The following case is of interest as it describes how a man may, slowly and unnoticed, bleed to death into his lungs.

Case 10.—Gnr. B. was hit by a piece of shell which entered on the right side of his nose, passing through the antrum and causing fracture of right upper edentulous alveolus. The fragment passed on through the floor of the mouth, fracturing the mandible, and on into the neck; it fractured the thyroid cartilage and hyoid bone and lodged in the precervical muscles of the fifth and sixth cervical segments. The chest was normal but bubbly, and clinically the brachial plexus was involved. On admission he was sitting on the stretcher barely conscious, respirations were 40 per minute and he had gross air hunger and tetany. Thus he had almost drowned by inhaling blood, and his unconsciousness was mainly anoxic. He was tilted head downward and the mouth and throat aspirated. A roentgenogram of the chest was practically normal. Operation was undertaken nineteen hours after injury for fitting of Gunning’s splints, removal of shell fragment, and closure of the face wound. After coecination of the larynx, anaesthesia was induced by 0.5 gm. of pentothal, and oral intubation was performed with a No. 8 Magill’s tube with an inflatable cuff. Maintenance was with cyclopropane. The bronchial tree was sucked out after intubation. Anaesthetic time was 127 minutes and bronchial aspiration was again applied at the end of the operation in addition to pharyngeal toilet. There were decreased breath sounds in the right side of the chest which were probably caused by a blood clot in the right lung. Aspiration was of no avail. He had a very poor cough reflex which was extremely difficult to elicit. Two days later a roentgenogram of his chest was perfectly clear; he had a little sputum and regular postural drainage was carried out. Seven days after wounding he had a small secondary haemorrhage from the mouth which occurred spontaneously. Six and a half
hours later he had a further brisk haemorrhage into his mouth. He spluttered and tended to inhale blood. He was taken to the operating theatre where he was given an intravenous premedication of omnopon, grain ½, with scopolamine, grain ¼, and without anaesthesia the clot and blood were cleared from the mouth. The source of bleeding was from the lower buccal sulcus and from the neck wound. He was tilted head downward to prevent aspiration and 2 pints of blood were given intravenously in two hours. He became quiet and unconscious, his colour was good and haemorrhage had stopped. He was observed in the theatre for three hours and, as haemorrhage had ceased and his condition had apparently improved, he was returned to the ward lying on his side with his head down. His pulse had steadied from 160 to 130 and blood pressure was 150 mm. systolic and 70 mm. diastolic. Four hours later, three minutes after the ward Sister had ascertained that he was breathing normally, he quietly died. Laryngoscopy, intubation, artificial respiration and insufflation of oxygen were done without avail. A clot was removed from the pharynx and this extended between the cords into the trachea from whence it was removed by Magill’s forceps. Postmortem examination showed a 2 inch vertical infected laceration of the right side of the pharynx extending down to the aditus of the larynx. The track extended along the fractured thyroid cartilage and intact larynx and hypopharynx to end in a pocket of pus around the infected transverse process of the sixth cervical vertebra. The right vertebral artery was filled with infected blood clot and this could be traced to its secondary rupture into this area. The trachea was almost clear. The right bronchus was practically filled with recent blood clot. The right lower lobe was solid with blood clot and airless, and there were some subpleural ecchymoses. The right upper lung was practically normal. The condition of the left lung was similar to that of the right, but it was less extensive. This case is of interest as the patient quietly drowned in his own blood; he never had a good cough reflex and this no doubt was partly responsible for his demise.

Case 5.—Pte. F., who has already been described under the section dealing with intubation without anaesthesia, was unconscious when admitted, with a mouth full of blood and a poor airway. His condition was poor; pulse was 70 and respirations were shallow, 35 or 40 per minute. There was fresh blood in both external auditory meati and cerebrospinal fluid was leaking from both nostrils. His airway was improved by the insertion of nasopharyngeal tubes. Operation was undertaken one and three-quarter hours after admission. He was intubated without anaesthesia with a No. 8 cuffed Magill’s tube; the cuff was inflated and anaesthesia was maintained with cyclopropane and oxygen in a circle closed circuit. Pharyngeal toilet and tamponage were done. The operation was for extraction of teeth, eyelet wiring, suture of tongue and primary suture of a chin laceration. No intermaxillary fixation was attempted on account of the tongue laceration. Subsequently he was very restless and never regained consciousness. He was treated with full doses of penicillin and sulfadiazine. A pharyngeal airway and nasopharyngeal tube were left in place for many hours. Mucus and cerebrospinal fluid collecting in the pharynx necessitated frequent suction. He died twenty-two hours after operation. Postmortem examination showed a fractured symphysis menti. There was a transverse laceration of the tongue 4 cm. long in its middle third, almost through its whole thickness; it was cleanly sutured. The tongue was not swollen. There was a small dural tear to the left side of the cribiform plate and a fracture about 0.5 cm. long just behind the cribiform plate. The ethmoid cells contained
cerebrospinal fluid. There was no fracture of the petrous temporal bone but
both ears contained blood. The brain showed moderate cerebellar coning
and there was a small contusion of the left mucus. The lower lobes of the lungs on
both sides were very congested but there was no extravascular blood or fluid.
The main bronchus on either side contained thick mucus and blood. "The head
injury alone, neither clinically nor at necropsy, appeared severe enough to
account for death. The severe tongue and jaw injuries, the aspiration of mucus
and blood and some cerebrospinal fluid may have caused sufficient cerebral
anoxaemia to intensify the effects of the head injury and make it into a fatal
one." (Major J. Shorstein, R.A.M.C.)

Case 11.—Lt. W. was wounded by a shell or mine and sustained a compound
fractured mandible with a penetrating wound of the knee joint and other multi-
ple penetrating wounds. He was operated on at a Field Surgical Unit, anaes-
thesia being C. E. and intratracheal ether. His wounds were excised and dressed.
He was admitted next day to the forward section of this Unit where he had an
operation for primary closure of his face wound and further treatment of his
knee by the general surgeon. Anaesthesia was induced with 0.25 Gm. of pento-
thal and oxygen and 4 ounces of ether was administered by a No. 10 oral endo-
tracheal tube in a closed circuit. Operating time was 187 minutes. Fifteen
hours later he was anaesthetised again with 0.75 Gm. of pentothal and oxygen
and 3 ounces of ether administered by a No. 9 nasal endotracheal tube with
circle carbon dioxide absorption. The operation was for the fitting of a Gun-
nings’ splint and intermaxillary fixation. Anaesthesia time was 93 minutes.
Next day he was restless and delirious and needed a nasopharyngeal tube to
give him a good airway. He had to be catheterised and had a temperature of
103 F. He was given 1 pint of blood and then alternate plasma and a penicillin
saline drip. He also had routine sulfathiazole. Next day he was seen by a
physician who could find no cause for his fever and there were no pulmonary
signs. He died the day after, this being the fifth day after injury.

Postmortem examination showed no gross infection of wounds or involve-
ment of body cavities. The lungs showed widespread and fairly severe blast
effects with eechymoses and small subpleural petechiae, some hypostatic con-
gestion and bronchopneumonia with commencing small abscesses. The abdomen
showed widespread subserous eechymoses, especially over the entire serious as-
pect of the bladder. The viscera showed no other abnormalities. Presumably
the blast lung injury plus mild sepsis which was uncontrolled by chemotherapy
was the cause of his death. It is a debatable point whether the three ether
anaesthetics over a short period of time tipped the scales in the wrong direction,
but after this fatality, patients suffering from blast lung injury were not anaes-
thetised if it could be avoided.

Case 12.—Fus. N. P. died 21 days after wounding, of cardiac failure and
bilateral bronchopneumonia. He was hit by a shell fragment which took away
his mandible from the symphysis to S region. He did not need resuscitation
and had a tongue stitch inserted by a Field Surgical Unit. The next day he was
admitted to the Forward Section. He was anaesthetised by 0.5 Gm. of pento-
thal and 2 ounces of ether by a No. 9 nasal endotracheal tube in a circle closed cir-
cuit and his air passages were packed off. The operation lasted 100 minutes.
A wound toilet and eyelet wiring were carried out. On intubation some thin yel-
low pus was coughed from his trachea and out of the endotracheal tube. Two
days later he was subjected to an operation of 156 minutes for repair of his
soft tissues. Anaesthesia was 0.75 Gm. of pentothal and cyclopropane and oxy-
Anaesthesia of Recent Injuries of Jaw and Face

Hagen by a No. 9 endotracheal tube in a circle closed circuit—cyclopropane was given because of his respiratory infection. He was evacuated next day to the Main Section where his wound broke down and he was given a course of sulfathiazole and penicillin without avail. He was on his way to the X-ray department on his twenty-first day when he collapsed and died.

Postmortem examination showed that the mandible was missing from symphysis to beyond the angle. There was body wasting, and 20 ounces of free fluid was found in his peritoneum. The liver was soft and the kidneys pale. The lungs showed purple patches of congestion and both lower lobes were firm. The cut surface showed some collapse of both lower lobes, and scattered areas of purulent bronchopneumonia and pus could be squeezed out of the bronchi.

Here, presumably, there was lower respiratory infection at the time or very soon after wounding, as shown by the coughing up of pus. In spite of penicillin and sulfathiazole and partly owing to the septic and purulent condition of his mouth he succumbed to cardiac failure from toxæmia associated with a low grade bronchopneumonia.

Comment and Conclusion

Patey and Riches' (1) unfair condemnation of induction of anaesthesia by an intravenous anaesthetic is based on one case quoted by Ascroft in which asphyxial symptoms rapidly developed. Such symptoms will rapidly develop during induction if a perfectly clear airway is not maintained and if anaesthesia is induced with a mouth full of blood or debris. I have used pentothal for three years and, with the exception of Case 9, no death has occurred during induction nor has a rapid plunge tracheotomy been necessary.

Haugen (3) and the American writers are quite right in maintaining that as many jaw injuries as possible should be done under local anaesthesia plus premedication. Morphone, grain ½, and hyoscine, grain ½00, or the normal premedication of omnopon, grain ½, and scopalamine, grain ½50, combined with local infiltration analgesia, is ideal for the more minor wounds and injuries of the soft tissues, and also in very severe injuries in which the patient is too ill to stand general anaesthesia. When there is coexisting closed head injury it is also the method of choice.

Bennett's (2) method of blind intubation, however, without topical anaesthesia, proved to be a very useful method for selected difficult cases and at times it can be life-saving.

Bentel (4) presumably was dealing with old maxillofacial injuries but it is considered that 2½ to 3 Gm. of pentothal would leave the patient in a depressed state for many hours without an active cough reflex and the hazards of suffocation in the postoperative phase would thereby be increased.

Shackleton (6) was dealing with patients whose wounds were three to six days old whereas patients admitted to this unit were injured about twenty-four hours previously. The problem is different in that
haemorrhage may still be occurring, there is no preparation for operation and the patients had had no rest during the long line of evacuation. The use of a face mask is strongly condemned in these early cases and it is considered that the anaesthetist has better control of the airway and of the patient under intravenous anaesthesia.

The method I suggested (8) for "old" maxillofacial cases is of no value in recent injuries because of the danger of intra-oral haemorrhage, and it is essential to perform a thorough pharyngeal toilet before intubation.

It is considered that the low incidence of respiratory complications was due to a thorough pharyngeal toilet, ensuring an active cough reflex at the end of the operation, and to the routine course of sulfathiazole for all patients and a course of intramuscular penicillin in the more severe cases.

**SUMMARY**

Four hundred and fifty anaesthetics of recent injuries of the jaw and face are analysed and a method of anaesthesia is described.

Various problems associated with jaw and face injuries are described and discussed.

Case histories are given in detail to illustrate the problems and hazards which occur.

The deaths of interest to anaesthesiologists are described and discussed.

**ACKNOWLEDGEMENTS**

I would like to thank Major P. Clarkson, R.A.M.C., for permission to forward this article and for his encouragement; Major R. Lawrie, R.A.M.C., and Capt. W. G. Grossman, R.A.M.C., for their encouragement and assistance.

**REFERENCES**