MINOR COMPLICATIONS OF GENERAL ANAESTHESIA

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The variety of complications of general anaesthesia that can reasonably be termed "minor", in that they constitute no threat to the long-term health and well-being of the patient, is so great that no serious attempt at complete coverage of these is possible within a reasonable space. It is proposed therefore, to consider the more common complications that are relevant to the current practice of general anaesthesia and to omit very rare ones. Patients can suffer a good deal of annoyance, discomfort and anxiety from these causes without their complaints being known by the anaesthetist. The problem is complicated by the fact that there is a striking difference between the frequency of spontaneously volunteered complaints, say, of sore throat, and that revealed by direct questioning.

In the early years of the history of anaesthesia, sequelae such as malaise, nausea and vomiting, which were frequent and often serious complications of general anaesthesia, and which lasted more than a few minutes, were probably regarded as inevitable prices to be paid for surgical treatment. The mortality of surgery is now much lower and it is to be expected that minor sequelae in general would assume relatively more importance to the patient and anaesthetist than formerly.

Edmonds-Seal and Eve (1962) presented a revealing set of results following an extensive enquiry into the minor complaints elicited during interview of more than 500 patients who had undergone general surgical procedures. About half the patients mentioned one complaint, and 16% more than one. In all, some 20 different types of complaints were made. These were grouped by the authors according to their relationship to the management of the airway, to the anaesthetic agents used and the manner of administration, and to the positioning of the patient during surgery. While well-recognized minor complications, such as sore throat, nausea and vomiting, and minor trauma to the teeth and lips, were matters for complaint, it was shown that a number of other annoyances may occur. Aches and pains resulting from the adoption of the lithotomy position, pain at the side of the jaw, headache and "bruising" from i.v. injection were amongst those noted with sufficient frequency to suggest that attention to refinements in the management of anaesthesia would be advantageous to patients.

Thomas (1963), who interviewed patients after minor gynaecological procedures, found that amongst the most unpleasant features of the return to consciousness was headache. Sore throat in the absence of intubation was occasionally reported. In 6% of patients, painful neck muscles were reported, caused by, in Thomas's opinion, excessive extension of the head with the object of obtaining a clear airway.

In an important study by interview, of post-anaesthetic morbidity in outpatients who had undergone minor surgical or diagnostic procedures under general anaesthesia, Fahy and Marshall (1969) found that close to half their number developed symptoms attributable to the anaesthetic. Again, headache, nausea and vomiting, and sore throat in those subjected to endotracheal intubation occurred with appreciable frequency; but of considerable interest was the finding that drowsiness and anorexia, with non-specific malaise, were not infrequent complaints and could affect the resumption of normal activities on returning home. Some 5% were prevented from following their normal occupations on the day after anaesthesia because of these symptoms. The duration of operation (less than or more than 20 min) bore a close relationship to anaesthetic morbidity. In this series, an unexpectedly low proportion of patients who had been given suxamethonium reported muscle pain. A subsequent study (Fahy, Watson and Marshall, 1969) conducted by questionnaire, showed that a higher proportion of patients reported a wider variety of complaints than had been uncovered by the interview method.

It is common knowledge that patients may complain of having dreams during anaesthesia. Recent evidence (Brice, Hetherington and Utting, 1970; Harris et al., 1971) suggests these to be a major and unpleasant cause of complaint associated with
light levels of anaesthesia. A study of postoperative complaints, undertaken by Cronin, Redfern and Utting (1973), revealed several disquieting sources of complaint relating to the anaesthetic. Recall of unpleasant dreams, sore throat, and return of consciousness before completion of pharyngeal suction and extubation, of disorientation and awareness of bright lights during the awakening period, were amongst the unsatisfactory features of the early period after an operation.

It is evident that the range of minor discomforts and complications is wider than has commonly been thought. It is clear also that the methods of obtaining information on these matters are critically important, if we are to gain increased insight into the problems so that better measures can be taken to lessen causes for complaint.

HEADACHE

The frequency with which headache is reported to occur after operation ranges from approximately 2 to 60%. Convincing reasons for this wide difference in results are not readily apparent. The method of enquiry is important; thus, direct or indirect questioning at interview may well provide different answers from the patient, as may the extent to which inpatients are encouraged to recall symptoms. Very brief or mild headache may go unremarked by patient or interviewer for various reasons.

It appears that females are more liable than males to develop headache (Tyrrell and Feldman, 1968; Zohairy, 1969). The scale of surgery and the duration of general anaesthesia, considered jointly, is not clearly a factor. A frequency of 35% was reported by Fahy, Watson and Marshall (1969) in patients of both sexes who replied to a postoperative questionnaire after minor genito-urinary procedures. Cronin, Redfern and Utting (1963) did not find that headache assumed an important place in the list of postoperative complaints revealed by interview and questionnaire following substantial general surgical procedures. Nor was headache common in the patients studied by Hannington-Kiff (1969) following major gynaecological procedures.

Halothane anaesthesia may be a relevant factor, judged from the work based on comparable groups of patients, reported by Tyrrell and Feldman (1968). Headache was found to occur in 60% of patients who had been anaesthetized with nitrous oxide and halothane when breathing was spontan-
"halothane headache" described by Tyrrell and Feldman (1968) was described as frontal, situated above or behind the eyes and continuous, though occasionally throbbing in nature. Their description is similar to that of Zohairy (1969). The severity is worst on wakening and this form of headache lasts 6–8 hr—a good cause for spontaneous complaint! In the study of Edmonds-Seal and Eve (1962), of the few patients who complained of headache, eight of the 12 in whom the symptoms were attributable to general anaesthesia had been given trichloroethylene, and the authors noted that the headache lasted about 24 hr.

Many questions remained unresolved. It might be suggested that the i.v. injection of atropine given alone as premedication for migraine sufferers should be avoided, especially if outpatient surgery is proposed.

MINOR LARYNGEAL SEQUELAE OF ENDOTRACHEAL INTUBATION

Although an extensive literature has accumulated on the serious complications that may follow endotracheal intubation, especially if prolonged as in the context of intensive therapy, there is a smaller volume concerned with the minor discomforts that can occur as a result of intubation in the course of general anaesthesia. Although these are often referred to as "sore throat", this term should probably be regarded as encompassing symptoms and signs such as discomfort associated with damaged teeth and laceration or bruising of gums, tonsillar pillar, pharynx and tongue, and the structures of the nasal cavity if this route be used. Estimations of the frequency vary considerably, this being probably caused in large part by the mode of eliciting complaints. It has been shown in several studies that direct questions give a higher incidence of complaints than is obtained if the investigation uses only complaints which are volunteered spontaneously. Hartsell and Stephen (1964) used questions not directly concerned with sore throat, but allowed patients to speak freely about postoperative discomforts; they found that fewer than 6% volunteered a complaint of sore throat. They also remarked that sore throat was rarely a primary complaint during the postoperative interview. This figure is similar to that reported by Gard and Cruickshank (1961) in relation to volunteered complaints, and rather less than the 15% reported by Jones and associates (1968). At the other end of the scale, Conway, Miller and Sugden (1960) found, upon direct enquiry, that 38% of intubated patients had sores throats (17% being "severe"). Gard and Cruickshank (1961) found that 44% of patients on direct questioning admitted to sore throat after intubation, a rather similar figure being reported by Jones et al. (1968). Wolfson (1958) elicited by interrogation a 21.3% incidence of complaints, a figure similar to that reported by Goddard, Phillips and Marcy (1967) for adults after direct questioning.

While these reports may suggest some improvement compared with the finding of Wylie (1950) that 70 of 100 patients suffered sore throat, it is salutary to note that Cronin, Redfern and Utting (1973) discovered that sore throat of some degree was complained of by more than half the patients who had undergone general surgery, and that in 6% it was regarded as the most unpleasant part of the recovery period.

The vast majority of minor complaints referable to intubation are mild and short-lived. It is to be noted that sore throat may be a complaint in as many as 10% of patients in whom no endotracheal tube has been passed. This finding is probably accountable to the use of oropharyngeal airways, to dryness of the mouth associated with the use of premedicant drugs, and to the withholding of fluids by mouth before anaesthesia.

Most workers appear to have found that females are appreciably more liable to complain of sore throat than males (Wolfson, 1958; Hartsell and Stephen, 1964; Gard and Cruickshank, 1961), but there was no appreciable difference in the sex incidence of the complications in the series of Jones and associates (1968).

The duration of anaesthesia and its relationship to the frequency of sore throat has been examined by several workers, and contrary to expectation, has been found to have no effect. A water-moistened pharyngeal pack is an aggravating factor (Conway, Miller and Sugden, 1960) and the presence of a nasogastric tube may well have an adverse influence (Conway, Miller and Sugden, 1960; Hartsell and Stephen, 1964), though other workers (Jones et al., 1968) have been unable to demonstrate any association. Straining on the endotracheal tube increases the number of complaints, according to Hartsell and Stephen (1964). Movement of the head during surgery, and the use of the prone operating position, have been said to be associated with an appreciably higher frequency of complaints (Gard and Cruickshank, 1961; Jones
and colleagues, 1968) though evidence is not conclusive on this point.

Attempts to reduce the frequency of complications by the use of lubricants of various types have not been very successful, although Lund and Daos (1965) reported that the use of 5% lignocaine contained in a heavy viscous base was successful in lowering the frequency of complaint elicited by direct questioning, from about 23 to 7%.

Hamelberg and associates (1958) undertook a study of the effect of hydrocortisone contained in the lubricant applied to the tube or applied by topical spray, and found no evidence of significant benefit. Intravenous injection of beta-methasone immediately after intubation was tried by Goddard, Phillips and Marcy (1967), and on direct questioning it was found that complaints of throat soreness or irritation in adults was reduced from 21 to 12.5%—a result that the authors noted to be statistically significant rather than clinically useful.

The majority of investigators agree that only a small proportion of patients develop severe symptoms, but presently available information does not make it possible to predict with any certainty which patient will, or will not, suffer from sore throat. Even the size of the tube seems to matter little (Jones et al., 1968), and similarly the presence of an inflated cuff appears to make no difference (Wolfson, 1958).

Considering the delicacy of the tissues liable to be traumatized, it is remarkable that voluntary complaint is not made on every occasion after the passage of an endotracheal tube. Hilding (1971), on the basis of extensive animal investigations and examination of human necropsy material, believed that the epithelium of the larynx and trachea must inevitably be damaged, especially over the arytenoid cartilages, the cricoid lamina and the anterior wall of the trachea. Donnelly (1969) observed pathological changes, consisting of focal epithelial loss and basement membrane disruption with empty capillaries, in postmortem specimens of the mucosa overlying the vocal processes and the posterior cricoid laminae, after intubation for periods as short as 1 hr. These observations were based on autopsy specimens from adults. Some of the damage may be made worse by the shape of the tube, and Hilding (1971) showed that the conventionally shaped tube is apt to distort the normal anatomical configuration and that suitable modification could be made to improve the shape, to reduce trauma.

Laryngeal granuloma is a rare complication of intubation arising as a result of trauma. It is generally sited on the posterior third of the vocal processes of the arytenoid cartilages, where the tube lies. Damage to the epithelium and perichondrium may be followed by infection and the formation of granulation tissue. An indolent ulcer may form, a sessile granuloma may develop, or pedunculation may follow fibrotic constriction of the base of the damaged area. It appears to occur only in adults and is more common in females (Snow, Harano and Balogh, 1966). The granuloma may be bilateral in as many as half the cases. Campkin (1959) states that postintubation granuloma is most common after thyroidec- tomy because the hyperextended neck inevitably leads to more than ordinary pressure by the tube on the posterior commissure and vocal processes of the glottis. An important aspect seems to be that hoarseness from this cause may develop some considerable time after the procedure. Campkin (1959) suggests that if hoarseness lasts for more than a week after endotraceal intubation, then investigation by indirect laryngoscopy should be undertaken.

**MUSCLE PAINS FOLLOWING SUXAMETHONIUM**

The occurrence of muscle pain and stiffness in the early postoperative period, when suxamethonium has been used during anaesthesia, has been recognized since the introduction of the relaxant into clinical practice over 20 yr ago. The discomfort usually lasts 2 or 3 days, but occasionally persists for as long as 6 days. It generally, but not always, appears on the first day after operation and is commonly complained of in the neck and shoulder and upper abdominal muscles, and is often described as similar to the stiffness that follows an unaccustomed degree of physical exercise. In the author’s experience, at worst these pains have been mistaken for pleurisy, meningitis and acute severe rheumatic syndromes by practitioners who have been consulted by their patients on returning home after day-case surgery.

Numerous clinical investigations of the problem have been undertaken, and the reported incidence of pain ranges from near zero to near 100%.

Churchill-Davidson (1954) first showed that pains in the muscles developed much more frequently in patients who are ambulant after operation than in those confined to bed. It is now fully accepted that early (especially immediate) ambulation increases both the likelihood of development
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of pain and its severity. It is generally accepted, too, that females are more prone than males to suffer this complication, and that children under the age of 10 develop pain rarely.

There appears to be no direct connection between the degree of visible muscle fasciculations after suxamethonium injection and the incidence and severity of pain. Newman and Loudon (1966) reported that the incidence and severity of pain after suxamethonium was less in patients of both sexes who were in a high degree of muscular fitness compared with their less fit colleagues.

The influence of the i.v. induction agent on the development of pain after suxamethonium was investigated in a carefully controlled trial by Clarke, Dundee and Daw (1964). With equipotent doses, they found that methohexitone was followed by a significantly lower frequency of pain than were thiopentone or thialbarbitone when each drug was used for induction of anaesthesia and during maintenance. Propanidid and the phenoxyacetic amine G.29505 were also associated with significantly lower incidence than thiopentone or thialbarbitone. Craig (1964) showed that injection of suxamethonium immediately after thiopentone was associated with a lower incidence of after-pain than when injection followed 5 min later. A much higher incidence was noted when a gaseous induction of anaesthesia was substituted for the i.v. method.

Waters and Mapleson (1971) showed that there is a tendency for suxamethonium-induced muscle pain to decrease when larger single doses are used (although they appreciated that in some instances a dose of, say, 200 mg might be inappropriate) and that multiple doses, each being given after full recovery from the preceding dose, were likely to increase the probability of occurrence of pain. The observation is in accord with their view that pain may be attributed to damage in muscle caused by inco-ordinate contractions preceding the onset of paralysis—the larger the dose the greater one might expect to be the degree of synchrony of contractions. On this basis, continuous infusion should be beneficial, because, after the initial dose, contractions of muscle will not occur again if paralysis is maintained. It is interesting in this connection to note that Crawford (1971) reported an extremely low incidence of suxamethonium-induced pains (1.5%) following operation in pregnant patients, the figure being significantly lower than (less than half) that in non-pregnant female patients. After an initial 100 mg dose, continuous infusion of suxamethonium was used. Whether this is a special feature of pregnancy "protecting" against the development of pain is hard to say. It is noteworthy that Bryson and Ormston (1962) reported a 50% incidence of pain after Caesarean section during which suxamethonium was used intermittently. The differences in results are difficult to explain.

An unexplained observation is the rarity of pain after anaesthesia for electroconvulsive therapy. The administration of suxamethonium by the i.m. route and the use of the bromide salt in place of the chloride do not lessen the frequency of muscle pain, nor indeed does the use of the related suxethonium in place of suxamethonium.

There is general agreement that small doses of non-depolarizing muscle relaxants, given before suxamethonium, lessen (but do not abolish) the incidence of muscle pain. The matter of timing is important; thus, in order to gain benefit, it is necessary to inject 5–20 mg gallamine or 3–5 mg tubocurarine at least 2 min before suxamethonium. Several writers have raised objections to this technique because of the possible development of a mixed neuromuscular block and a reduction in effectiveness of the normal dose of suxamethonium. Cullen's (1971) observations led him to the view that if gallamine (10–20 mg) is given 3 min before suxamethonium (1.5 mg/kg), conditions for intubation are as satisfactory as those obtained when suxamethonium is given alone. When tubocurarine (3 mg) was substituted for gallamine, the onset of paralysis was delayed. Freund and Rubin (1972), assessing neuromuscular block by the magnitude of twitch responses, concluded that prior administration of tubocurarine (3 mg) decreased the blocking action of suxamethonium to the extent that at least 70% more than their standard dose of 0.7 mg/kg was required. In a subsequent comment, Miller (1972) supported the administration of non-depolarizing relaxants beforehand in this manner, noting that the fear of desensitization block and prolonged apnoea is probably unfounded, judged by published results.

It is substantially as true now as in 1964, as Craig remarked, that "... apart from the prior use of non-depolarizing relaxants in small doses, no drug or combination of drugs has been found which consistently reduces the incidence of pain, and so far no successful treatment of established pain has emerged."
The observations of Gupte and Savant (1971) are of particular interest, that treatment with vitamin C tablets, 500 mg b.d. on the day before, on the day of, and on the day after per-oral endoscopic procedures led to a considerable reduction in the frequency with which pain developed in adults of both sexes. It remains to be seen whether advances will be made from this observation.

POSTOPERATIVE VOMITING

It is often assumed that sickness after operation is now not very common, and rarely severe when surgical causes are excluded. The investigation undertaken by Cronin, Redfern and Utting (1973), however, showed that nausea and vomiting remain significant causes for complaint after general surgery. It was experienced by about half their patients and in some was the worst feature of the postoperative period. It did not appear to be related to the number of doses of analgesic drug given for pain. Anaesthesia consisted of thiopentone, tubocurarine, nitrous oxide and oxygen, no volatile supplement being used.

It is difficult to establish with certainty the role of individual factors which may affect postoperative vomiting, because a particular influence, for example the duration of anaesthesia, may be adverse only in some circumstances. Reported results require to be interpreted with an appreciation of the differences in modes of assessment of sickness. Thus, observation over a short period, perhaps excluding vomiting on emergence, and including emesis only after expulsion of material for pain, Anaesthesia consisted of thiopentone, tubocurarine, nitrous oxide and oxygen, no volatile supplement being used.

Sex. There is general agreement about the greater tendency for women to suffer sickness after operation. This difference persists independently of the duration and type of anaesthesia used, and is seen when similar operations are performed in both sexes (Boulton, 1955). Purkis (1964) found that not only was there a greater incidence in women both during the first 6 and the first 24 hr after operation, but the severity of sickness was greater also. The interdependence of influencing factors is shown by Dyrberg's (1962) report indicating that there was a marked difference between the sexes after abdominal operations, but much less after non-abdominal procedures.

Site of operation. This is accepted by most, but not all, investigators as an important influence on postoperative sickness. Even small differences in the operative procedures can modify the incidence. Dundee, Nicholl and Moore (1962) noted, in closely controlled circumstances, that nausea and vomiting were consistently more common after cervical dilatation and uterine curettage than after curettage alone. Gold (1969) was unimpressed with the differences attributable to operation site in his recovery room study of gynaecological patients. Purkis (1964) showed good evidence to support the view that vomiting is more common following intra- than extra-abdominal procedures, that the difference remained when considering operations in one sex, and also when comparing intra- and extra-abdominal operations of different duration. Fenestration operations were reported by Burtles and Peckett (1957) to be followed by a particularly high incidence of vomiting.

The duration of the procedure has been shown to be an important influence in some studies but not in others (Gold, 1969; Dyrberg, 1962). It seems likely that duration of anaesthesia is a factor when potent agents are used, but is much less important than other influences when currently popular techniques of general anaesthesia are used, except in the case of very brief procedures. In regard to the last point, Dundee, Nicholl and Moore (1962) showed convincingly the direct relationship between postoperative emetic symptoms and duration of anaesthesia within the 4–12 min range.

The choice of anaesthetic agent is not so obvious an influence as it appears. Purkis (1964) found that the incidence of emesis was greater over the first few hours when cyclopropane or ether had been used, than was the case with nitrous oxide with or without halothane, a finding similar to that reported by Gold (1969). The former author noted, however, that these differences were less well-marked when the whole of the first 24-hr period after operation was reviewed, although differences in severity as opposed to incidence were apparent.
Air-ether anaesthesia was reported by Holmes (1965) to be no more prone to cause vomiting after operation than were other currently popular techniques, when employed for surgery in general surgical and gynaecological patients. When the technique consisting of thiopentone, nitrous oxide and oxygen with muscle relaxant is used, other influences, especially the site of operation and the sex of the patient, assume a much greater importance.

The choice of premedication is certainly a factor of importance but it is difficult to define the critical circumstances (Morrison, Hill and Dundee, 1968). Following a study of premedication in patients undergoing minor gynaecological procedures under a standard form of anaesthesia, Dundee, Loan and Morrison (1970) showed the marked tendency for opiates (natural, semi-synthetic and synthetic) to cause nausea and vomiting after operation. The beneficial, although short-lived, effect of hyoscine and atropine in counteracting this tendency to sickness was also demonstrated (Dundee, Moore and Clarke, 1964). It is so well known that morphine causes sickness that perhaps the observations in volunteers reported by Comroe and Dripps (1948) are worthy of emphasis. They showed that a close relationship existed between movement and sickness after morphine administration, and noted that sickness was sometimes delayed for several hours after administration. Wangeman and Hawk (1942) had observed earlier that the tendency toward nausea after morphine administration could persist for as long as 18 hr.

It is easy to accept that morphine-like drugs used in premedication may be important in causing sickness after minor operations, after which the patients are soon active. One is on less secure ground in attributing an adverse effect of these drugs when given before more prolonged procedures, after which the patient may be relatively immobile for some hours and, in addition, will be given analgesic drugs for the management of pain after operation. Gold (1969), from his recovery room study of gynaecological patients, found little to suggest that premedication was of any great importance in determining the frequency of occurrence of sickness. Pethidine premedication was found to be associated with more postoperative vomiting than was morphine, by Bellville, Bross and Howland (1960).

As an alternative form of premedication, unlikely to cause sickness after operation, diazepam appears preferable; lorazepam and nitrazepam can also be considered as suitable alternatives.

Innumerable additional influences may have a bearing on the development of sickness after operation, and have been critically reviewed by Purkis (1964). In connection with personal predisposition, Dundee (1968) has remarked that “Some patients are sick after the most trivial procedures even when anti-emetic drugs are given, while a small proportion will have neither nausea nor vomiting after any type of operation, premedication or anaesthetics.”

Armer (1952) believed that sufferers from motion sickness are more liable to be sick after anaesthesia, although the present writer has been unable to confirm this. Purkis (1964) showed good evidence to support the belief that a predisposition to sickness, indicated by a history of emetic symptoms after previous operation, increases the liability to sickness on subsequent occasions.

Whether episodes of arterial hypotension during surgery have an adverse effect is not clear. Bellville, Bross and Howland (1960) found evidence in favour of this view, but Purkis (1964) found that hypotension during surgery was actually associated with less rather than more postoperative emesis.

The effect of prolonged postanaesthetic sleep in lessening the tendency to sickness is unproven. Possibly, early intake of fluid and food and the vestibular stimulation associated with changes in position are relevant factors promoting sickness, especially when morphine-like drugs have been administered. Skill in administration of anaesthesia is not correlated indisputably with the incidence of postanaesthetic sickness.

Anti-emetic drugs are numerous, and several have been used in the prevention of postoperative sickness. It is questionable whether routine use of these drugs is justifiable. As has often been noted, not all patients will suffer postoperative sickness, so that some would have been treated unnecessarily. In addition, anti-emetic drugs are not found to be 100% effective when their actions are studied in large series. Several phenothiazine derivatives have been shown to have anti-emetic properties. From the butyrophenone series, haloperidol appears to be effective (Dyrberg, 1962) as does droperidol (Patton, Moon and Dannemiller, 1974).

Metoclopramide has been studied by several investigators, although the reported results are in disagreement. Clark and Storrs (1969) commented
favourably, having studied patients undergoing evacuation of the uterus following incomplete abortion. Lind and Breivik (1970) thought it superior to perphenazine when given at the termination of major gynaecological operations. Neither Ellis and Spence (1970), nor Shah and Wilson (1972), were able to detect significant evidence of benefit following the use of metoclopramide before minor gynaecological operations, a view which accords with the finding of Dobkin, Evers and Israel (1968) from upper abdominal operations for which methoxyflurane anaesthesia was used. A later study by Breivik and Lind (1971) found that metoclopramide appeared to have an effect in reducing vomiting in female patients undergoing cholecystectomy, but their results did not achieve statistical significance. It would not appear that there is a very impressive advance toward the development of an anti-emetic drug which is highly effective in circumstances when vomiting is likely to be most troublesome, and is at the same time free from unwanted side effects.

NERVE COMPLICATIONS

Nerve damage affecting the brachial plexus or the radial and ulnar nerves, can hardly be regarded as a minor complication of anaesthesia. In many instances the effects are far from minor, and most arise from malpositioning of the patient on the operating table rather than from the anaesthetic procedure itself. Interested readers may refer to the study by Parks (1973) who reviewed 72 cases of peripheral nerve complications arising in association with surgery, and to reviews such as those of Nicholson and Eversole (1957), Lincoln and Sawyer (1961) and Britt and Gordon (1964).

However, it is pertinent here to refer to some minor nerve injuries which are more directly related to anaesthetic technique.

The median nerve is at risk when i.v. injections are made into the median side of the flexor surface of the elbow. Denison-Davies (1966) gave brief descriptions of cases showing a minor degree of damage following injection of thiopentone at this site, and Tesoriere (1956) reported two cases of temporary median nerve damage resulting from use of the antecubital fossa for thiopentone injection. It was demonstrated by Pask and Robson (1954) that the median nerve is in peril if irritant fluids are injected at this site, particularly if quite minor movement of the limb accompanies injection.

Damage to the supra-orbital nerve, resulting in numbness over the forehead and scalp of the affected side, accompanied by pain in the eye and photophobia, was described by Barron (1955). This complication was attributed to pressure caused by the endotracheal catheter mount which had been held in place by means of a Hudson harness, despite the interposition of a piece of gauze tissue, during a 2 hr operation. Sensation returned to normal in 3 weeks. Keats (1956) described three cases of pressure injury to nerves supplying the scalp, caused by tight application of an H-type head harness attached to a facepiece. The patients complaints were of unilateral hypersensitivity and numbness over part of the scalp, and although recovery apparently took place, it was slow.

That factors apart from direct damage by pressure, stretching or injection of irritant solution, need to be considered in connection with damage to nerves revealed after operation, is shown by the case report by Jones (1967). On awakening, his patient complained of cramp in the left hand. Several days later the signs of ulnar nerve damage had developed, and total palsy rather than recovery followed over the subsequent year. There was no obvious cause for nerve damage related to the conduct of anaesthesia or the position of the patient on the operating table. However, the patient was a diabetic of mild degree and it was considered possible that, in this instance, the conventional care of the arms on the operating table was insufficient to protect from trauma the peripheral nerves of a diabetic patient, which show unusual sensitivity to damage. Of interest in this connection is the discussion by Nicholson and Eversole (1957), of aetiological factors other than trauma causing peripheral nerve lesions. They emphasize the necessity to exclude factors such as alcoholism and exposure to heavy metals, before indicting trauma as the sole cause of peripheral nerve injury.

Temporary partial facial paralysis, as a sequel to digital pressure applied behind the angles of the mandible, was described by Fuller and Thomas (1956). In both their cases a clear airway had been difficult to maintain, so that this manoeuvre was essential. As the authors commented, it might be expected that such a complication would occur more often than published reports indicate. Temporary facial nerve palsy may also follow operation in the prone position. Chandra and Khanna (1968) described such a case in a small boy where continuous pressure on the right side of
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the face was followed by swelling of unknown aetiology, accompanied by paresis of the muscles of the face on that side.

Damage resulting from badly placed injections is an ever present risk which is avoidable. Injection into the arm below the deltoid muscle carries a risk to the radial nerve in the spiral groove, and injection into the arm below the deltoid muscle carries an ever present risk which is avoidable. Injection of the face was followed by swelling of unknown origin. Althesin was associated with a similar frequency of venous sequelae, but with propanidid the incidence was greater (about 11%).

VENOUS COMPLICATIONS
Following i.v. injection of drugs there may develop ecchymosis, tenderness, thrombosis, or thrombophlebitis. Local tissue necrosis may occur at the site of thiopentone injection, and may lead to sloughing (Denison-Davies, 1966). Carson and associates (1972) showed that venous complications are infrequent following 2.5% thiopentone or 1% methohexital, occurring in 2–3% of patients. Althesin was associated with a similar frequency of venous sequelae, but with propanidid the incidence was greater (about 11%).

EYE COMPLICATIONS
Corneal abrasion can occur easily in the anaesthetized patient, and avoidance is a matter of care during application of the facepiece, intubation, towelling of the head and covering of the eyes whenever surgery of the mouth, head or neck is to be performed. Reduction in intraocular tension attributable to pressure by a facepiece has been demonstrated (Brittain and Brittain, 1945). The authors observed this to occur in one eye, the pressure returning to normal on average within 6–9 hr, and being followed by a rise above normal; this was considered to be a possible cause of precipitation of acute glaucoma in a susceptible patient.

MISCELLANEOUS COMPLICATIONS
Alopecia has been reported by Abel (1964) following prolonged pressure on the scalp during anaesthesia, usually over the vertex or upper occiput. Hair loss occurs up to 30 days after operation, regrowth occurring over 4 months. Pain, swelling, exudation, and crusting were noticed in the area upon which the head rested.

Parotitis. Pressure, such as may occur inadvertently when the patient is placed in the lateral position was thought by Binder (1961) to be a causal factor in the development of parotitis. It does not seem likely to be a complication of anaesthesia itself. It is rare, in any event.

Every reader will be able to recall minor complications (sometimes from personal experience), mention of which has not been made in a necessarily brief review of an extensive subject. However, this will have served some useful purpose if it acts as a stimulus to continued enquiries into the subject, and to redouble our efforts to minimize the trauma, physical and mental, that can be associated with receiving an anaesthetic.

REFERENCES


