

Quality of Anaesthesia Disposables

The art of administering anaesthesia has been associated with flexible tubes and pipes ever since its birth. The ether, chloroform and nitrous oxide etc. all had to be conveyed to the airways of the patient through some sort of tube. Rubber was the main medium which was employed in the earlier days and remained in use for many decades to come. Antistatic properties produced with the addition of carbon gave the notorious black colour to the anaesthesia delivery systems including gas circuits, face masks and reservoir bags. Sir Ivan Whiteside Magill (1888-1986) was an Irish born anaesthetist who is famous for his involvement in much of the innovation and development in modern anaesthesia. He worked at the Queen's Hospital, Sidcup in 1919 as an anaesthetist. The hospital had been established for the treatment of facial injuries sustained in the World War I. Working with plastic surgeon Harold Gillies, he was responsible for the development of numerous items of anaesthetic equipment but most particularly the single-tube technique of endotracheal anaesthesia. Necessity is the mother of invention and the development of endotracheal tube (ETT) was driven by the immense difficulties of administering "standard" anaesthetics such as chloroform and ether to men with severe facial injury using masks; they would cover the operative field. These endotracheal tubes were made of red or yellow rubber. Portex Medical (England and France) produced the first cuffless plastic 'Ivory' ET tubes, in conjunction with Dr Magill's design, later adding a cuff as manufacturing techniques became more viable, these were glued on by hand to make the famous Blue-line tube copied by many other manufacturers. Mallinckrodt GmbH developed the disposable ETT and produced a plethora of design variations. These tubes are usually curved to facilitate insertion. Nasal

tubes were made more supple, were thin walled, had a larger radius of curvature and their bevel was more tapered; all these features were aimed to make these less traumatic and facilitate nasal insertion. Similarly, many other devices, including suction catheters, suction bulbs and tracheostomy tubes etc. continued to be made from rubber. All these were reusable due to their high cost; and had to be autoclaved after each use, which shortened their life besides producing minute cracks in their surface. The fear of transmission of disease especially hepatitis and AIDS, led to replacement of rubber with polyvinyl chloride (PVC) material, and all disposable devices started to be manufactured from this material.

The present day ETT's are made of PVC and are usually very stiff. Even with flawless technique, the tubes of some makes can be felt to abrade the anterior or lateral walls of the trachea by a gritting feeling conveyed to the holding hand after passing through the glottis. Some companies have recently introduced tubes with a soft flexible tip, but their use has been very limited due to marketing problems. Moreover, all tubes are made for both nasal and oral insertion, without any difference in the radius of curvature, the shape of the bevel or thickness. Although variations do exist, nasal insertion of these tubes invariably leads to mucosal trauma. There is a large variation in the quality, and a wide spectrum of all parameters is available. Usually the cheapest and lowest quality tubes are purchased by most of the surgical centers. These low standard tubes come with a variety of manufacturing defects; these include, increased stiffness, non-standard radius of curvature, increased thickness of the wall, increased diameter at the balloon, and last but the most important, very narrow inner lumen of the distal end of the connector. Incidences have been reported when pin

hole connectors were found attached with No. 4 ETT, which should have been 4 mm¹⁻². The very high resistance offered by these connectors lead to postponement of some pediatric surgeries. Luckily there has been no fatality reported. These tubes remain in use throughout the country even now.

Suction catheters are in extensive use in every ward and every operating room of every hospital, for suctioning of secretions from the oral cavity either directly per orum or through the nasal passages, and from the endotracheal tubes. Disposable suction catheters are made of PVC material and are available in different sizes. Some of these have an open distal end, while others have a closed one. Usually two or three side holes are made at the distal end to facilitate suction. While suctioning, the catheters are usually moved to and fro and may even be rotated in a semi-circular motion by some healthcare professionals. In this way, the catheter comes in close contact with the mucosa of the nasal passages and the upper branches of the tracheobronchial tree. Recently it was observed that on removal, the catheters of a particular make were always littered with blood. In a few cases nasal passage of the catheter resulted in frank bleeding. On inspection, it was revealed that the tips of the catheters of this make were sharp cut with the edges felt on the finger tip. Even the holes on the sides were so punched out so as to feel very sharp over the finger tip. These were obviously capable of abrading the delicate mucosa of the upper airways. Secondly, some of the catheters were too stiff, held straight and difficult to bend easily according to the anatomical features of the upper airways.

Similarly, most of us routinely come across disposable syringes, which have long replaced old glass syringes. Local made and imported, various makes are commonly available. The common defects observed are non-compliant plungers which result in reverse spill of the drugs, very resistant plungers and blunt and rough needles which result in bleeding on

every injection.

The compromise in quality is not restricted to catheters and syringes; epidural sets, which are marketed at a relatively high cost, are also prone to faults. A set of famous manufacturer was noticed to contain epidural needle and the catheter of the same gauge, making it impossible to thread the catheter. Many bacterial filters have been found to start leaking at the side, on third or fourth injection through these, necessitating opening up of a new set just to replace the filter. This adds to the financial cost of the patient care.

The terms cost-benefit, cost-effectiveness, economic necessity and cost-control are being used more increasingly now than ever. The health sector is facing the financial crunch more than any sector of the government system. But it must be realised by all concerned authorities that the morbidity and even at times needless or preventable mortality that results from the low quality purchases does not in any sense cut down costs, if total costs borne by the patient are taken into consideration. The Joint Commission on the Accreditation of health Care organizations (JCAHO) defines quality of patient care as "the degree to which patient care services increase the probability of desired patient outcome and reduce the probability of undesired outcomes, given the current state of knowledge³." Low quality disposables defy the concept given therein by increasing the chances of undesired outcomes, e.g. upper airways injury, sore throat, or even hypoxia. The postponement of a single surgery may be weighed in terms of cost, but the mental torture by the patient and the family might well be beyond any measurable scale.

The search at internet did not reveal any laid down standards regarding the shape of the tips or the side holes or about the flexibility of the PVC catheters. Manufacturers have their own sets of standards which might not always be adhered to. The purchasing authorities are usually more concerned

with the cost effectiveness rather than quality. We feel that the injuries and the morbidity caused by substandard tubes and catheters are enough to prompt the concerned health authorities at national as well as international level to formulate proper standards regarding the above mentioned observations. The tips of the catheters should either be closed with a rounded distal end or the edges should be smoothed out. Similarly, the edges of the side holes must be smoothed out. A standard must also be laid down for the desirable flexibility of the tubes and catheters at the usual ambient temperature in the operating rooms or the intensive care units, where these are so frequently used. The purchasing authorities, meanwhile are urged to go for good

quality for the sake of reducing the needless morbidity in the patients.

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