

# Prevention of Human Error by Colour Coding in Operation Rooms and Intensive Care Units.

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## **ABSTRACT:**

Anaesthetists use a multitude of drugs in their practice in operation rooms as well as in intensive care units. Anaesthesia is a unique specialty in that the route of administration of drugs chosen is almost always intravenous. The syringes are usually prefilled for each patient use and there are chances of injecting a wrong drug with catastrophic results if due precautions are not taken. This article presents an easy and economical way of colour-coding syringes and infusion bottles.

**Key Words:** Error, hazards, Colour Coding.

## **INTRODUCTION**

Anaesthesiology is a unique speciality in which the anaesthetist has to choose the intravenous route in his subjects for administration of drugs. Oral route is not available due to obvious reasons, and intramuscular and rectal routes are unpredictable or lack the control, which is needed for a safe anaesthesia.

Preanaesthetic preparation for a particular surgery includes prefilling a number of syringes of assorted sizes with drugs intended to be used in a particular patient. Anaesthetist uses these drugs according to a precalculated dosage regimen or empirically to the desired effect. This is also the unique feature of this specialty that you inject the drug and watch the desired effect coming on. A less trained anaesthetist in stressful conditions is apt to err, with disastrous results by injecting a wrong drug.

## **HUMAN ERROR IN ANAESTHESIA:**

The Oxford dictionary describes an error as something incorrectly done through ignorance or inadvertence, a flaw or malformation. In anaesthesia, errors can either be the result of human or equipment failure. Human errors contribute to 65-80% of all errors in anaesthesia<sup>2-4</sup>. Three types of human error can be distinguished: slips, mistakes and omissions.<sup>5</sup> Slips are errors in which the intended action was correct but the actual action was wrong. A mistake is an error, where

intention itself was wrong. An omission is the failure to act when an action is required.<sup>6</sup> Failure to check the equipment before use, or failure to turn on the monitor is an omission.

Studies based on voluntary recollections of anaesthetists have demonstrated that human error may be responsible for at least 70% of negative outcomes of anaesthesia<sup>8</sup>. Even the experienced anaesthetists are not immune to serious management errors. A study by Wang and Hageral looked into the reported anaesthetic complications during an 11-year period retrospectively. Among 262,850 anaesthetics administered over a 10 year period, 127 complications occurred with 7 deaths, out of these 96 complications were judged to be avoidable<sup>12</sup>. Interestingly, it was found that same complications tend to recur in anaesthesiology departments, indicating that the human factor plays a major role in the development of events preceding anaesthetic complications. In this department, 80% of the reported complications could have been avoided. The incidence of syringe swap (using the wrong prefilled syringe or label errors) was responsible for 1 in 35,000 incidents of adverse outcome. The same ratio is found in studies in 50's, 60's, 70's, and 80's. In England and Wales between 1982 and 1984, one maternal death was attributed to drug misuse, out of total of 18 maternal deaths reported solely due to anaesthesia<sup>1</sup>.

The practice of using multiple drugs is on an increase, and this includes tranquilizers, narcotic analgesics, anti sialagogues, induction agents and an array of diluted or undiluted muscle relaxants. Some anaesthetists keep lignocaine, Indral or similar drugs ready for use. All this has compounded the problem and the chances of injecting wrong drug by error or neglect have been increased.

Cooper and Chopra in two different studies concluded that human errors involving drug administration, airway management and ventilation are the most common.<sup>4-6</sup> Most of the errors in drug administration involve picking up the wrong syringe, drawing up a drug from



the wrong ampoule and inadvertent or relative drug overdosage. Chopra et al in their study of 1990, listed some faults as follows;<sup>7</sup>

- Intramuscular suxamethonium instead of ketamine to a child.
- IV sodium citrate instead of potassium chloride.
- Adrenaline given instead of atropine.

Of the factors associated with human errors during anaesthesia, failure to perform a proper check is the most frequently reported.<sup>3-4</sup> Lack of vigilance, carelessness, distraction, inadequate experience and haste are other commonly associated factors. Kumar et al at University of Iowa have advocated use of check lists to avoid errors. They reported a decrease in incidence of syringe swap from 16 before adopting a checklist to 5 after adoption.<sup>7</sup>

**PREVENTION BY COLOUR CODING:**

What to do to prevent such a dramatic human error from occurring in our operation theatres or ICU's? A very simple and cost effective method of labeling syringes and infusions is presented with use of colour codes. In fact labeling by ordinary sticking plaster pieces is in



Fig 1: 1.5 x 4 cm sticker for syringes

common use in our country. It has two major disadvantages. It comes only in white, and has a tendency to get dirty on contact of user's hands. Use of multi-coloured sticker paper will add another dimension to the safety, as a different colour will readily attract the user's attention and he will correct his error. The proce-

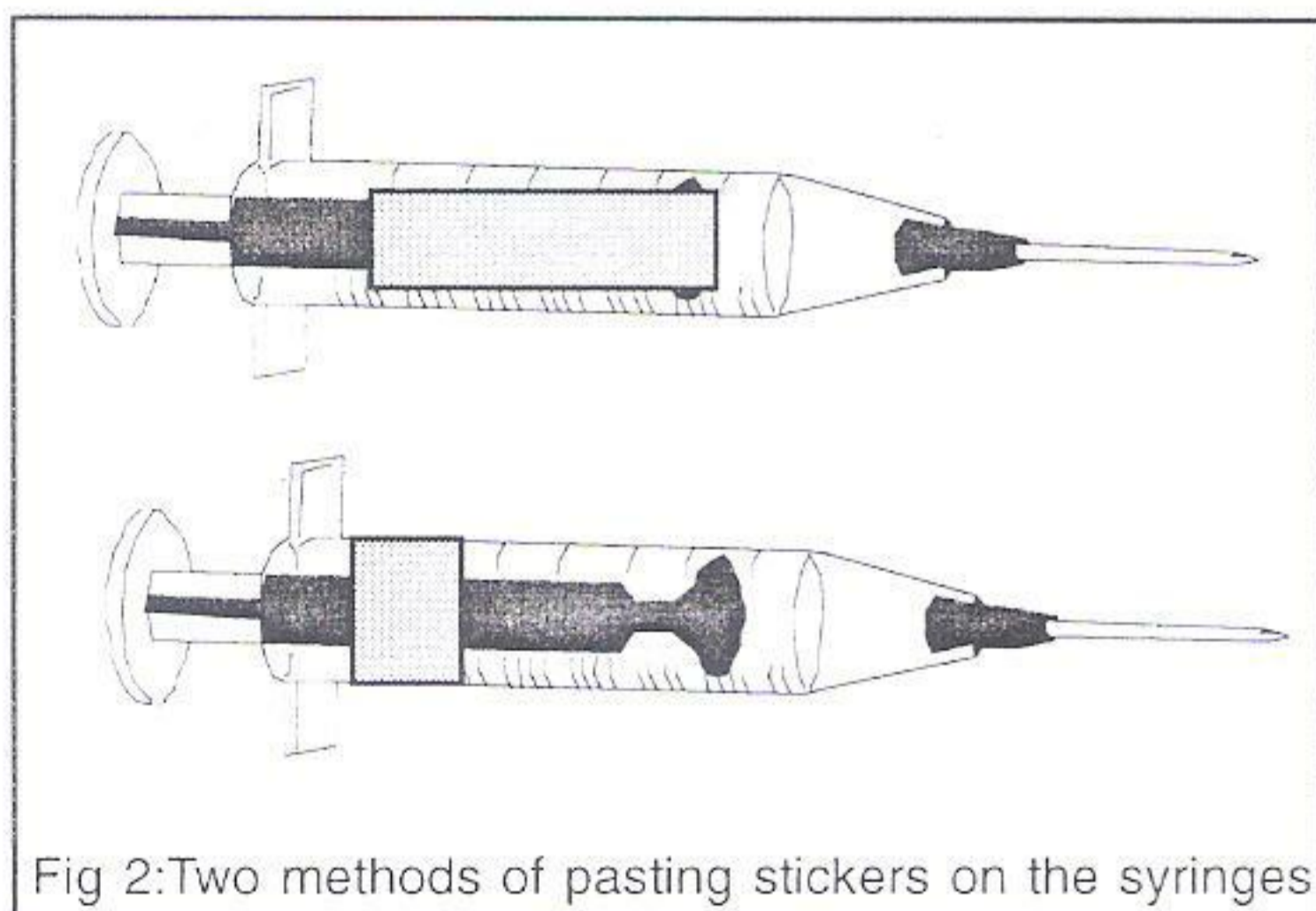


Fig 2: Two methods of pasting stickers on the syringes

dure is not fool-proof, but long standing use at AFIU and

CMH Rawalpindi has confirmed its superiority as compared to the conventional methods in preventing error.

**MATERIALS & METHOD:**

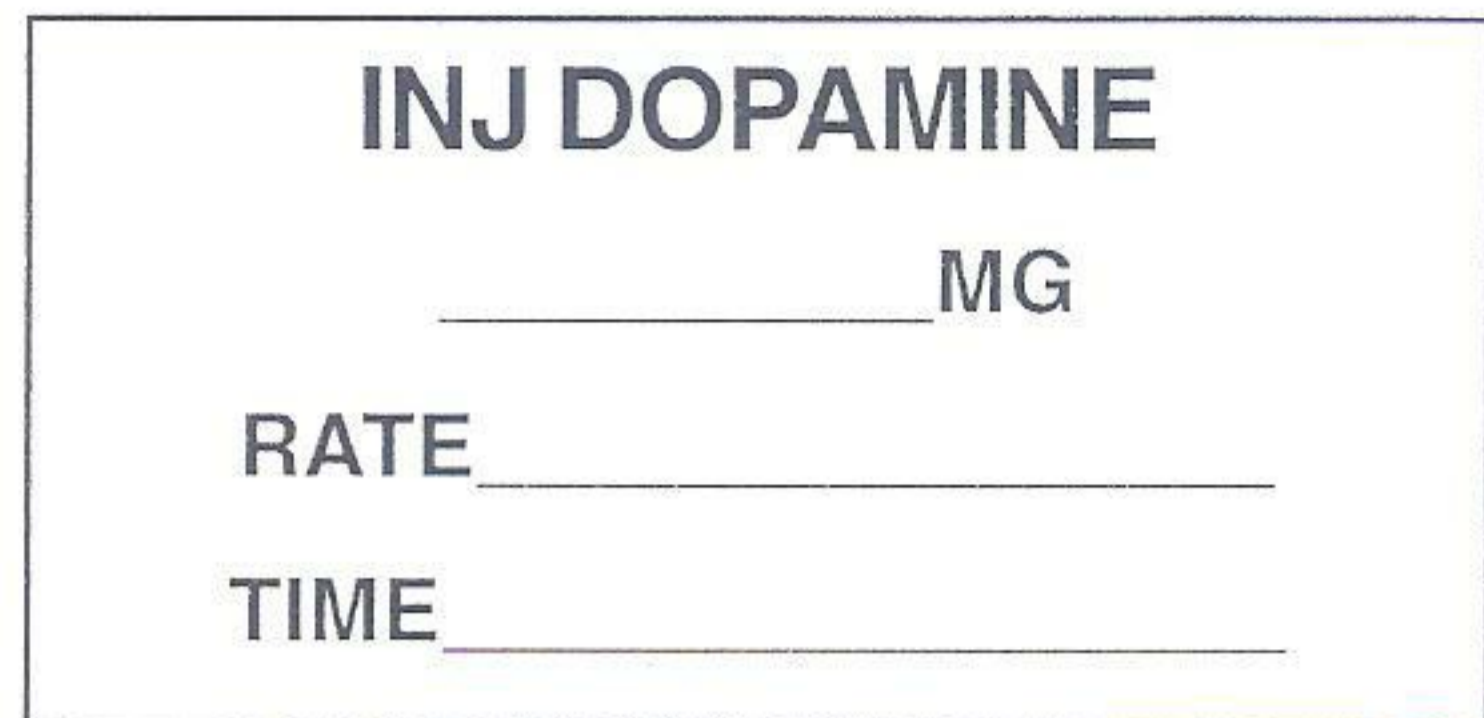


Fig 3: 5 x 10 cm sticker for infusion bottles



Fig 4: 1.5 x 4 cm sticker for infusion line

Sticker sheets are available in the market in different colours. Usually 4 A-4 size pieces can be cut out of a single sticker sheet. These A-4 size sheets are then printed with names and dosage of common drugs according to Table I. Laser printers are now in common use in most of our hospitals, and can effectively be used for printing stickers. A sticker will usually be 1.5x4 cm in dimensions. These are then cut out with a scissors or blade and pasted on specific syringe either longitudinally or transversely as shown in Fig. 1. The syringe

TABLE-I SUGGESTED COLOUR CODING AND SYRINGE SIZES				
Colour Syringe size	GREEN	YELLOW	ORANGE	RED
1cc	-	-	ATROPINE	-
2-3cc	VALIUM	-	-	PAVULON
5cc	DORMICUM	NEOSTIG + ATROPINE	SCOLINE	ATRACURIUM
10cc	-	PETHIDINE/NUBAINE	-	PAVULON 2+8
20cc	PENTOTHAL	-	-	-

size is also very important. The drugs, which are routinely diluted, e.g., pentothal sodium, usually require larger syringes. Hence the size of the syringes also varies according to the drug used and a suggested plan is shown in Table 1.



For IV infusions of vasoactive drugs, similar regimen is suggested (Table 2). A relatively larger sticker is pasted on infusion bottle or burette. Its usual size may be 5 x 10cm, for easy viewing from a distance. A smaller

TABLE-2 COLOUR CODING VASOACTIVE DRUGS				
WHITE	GREEN	YELLOW	ORANGE	RED
Lignocain ___ mg	TRIDIL	Isoket 10/20mg	Dobutamine 250mg	Dopamine 200/400 mg
Ventoline				

sticker of 1.5 x 4 cm is wrapped near distal end of the infusion line. It serves the purpose to identify the infusion line with specific drug when multiple lines are running (Fig 2).

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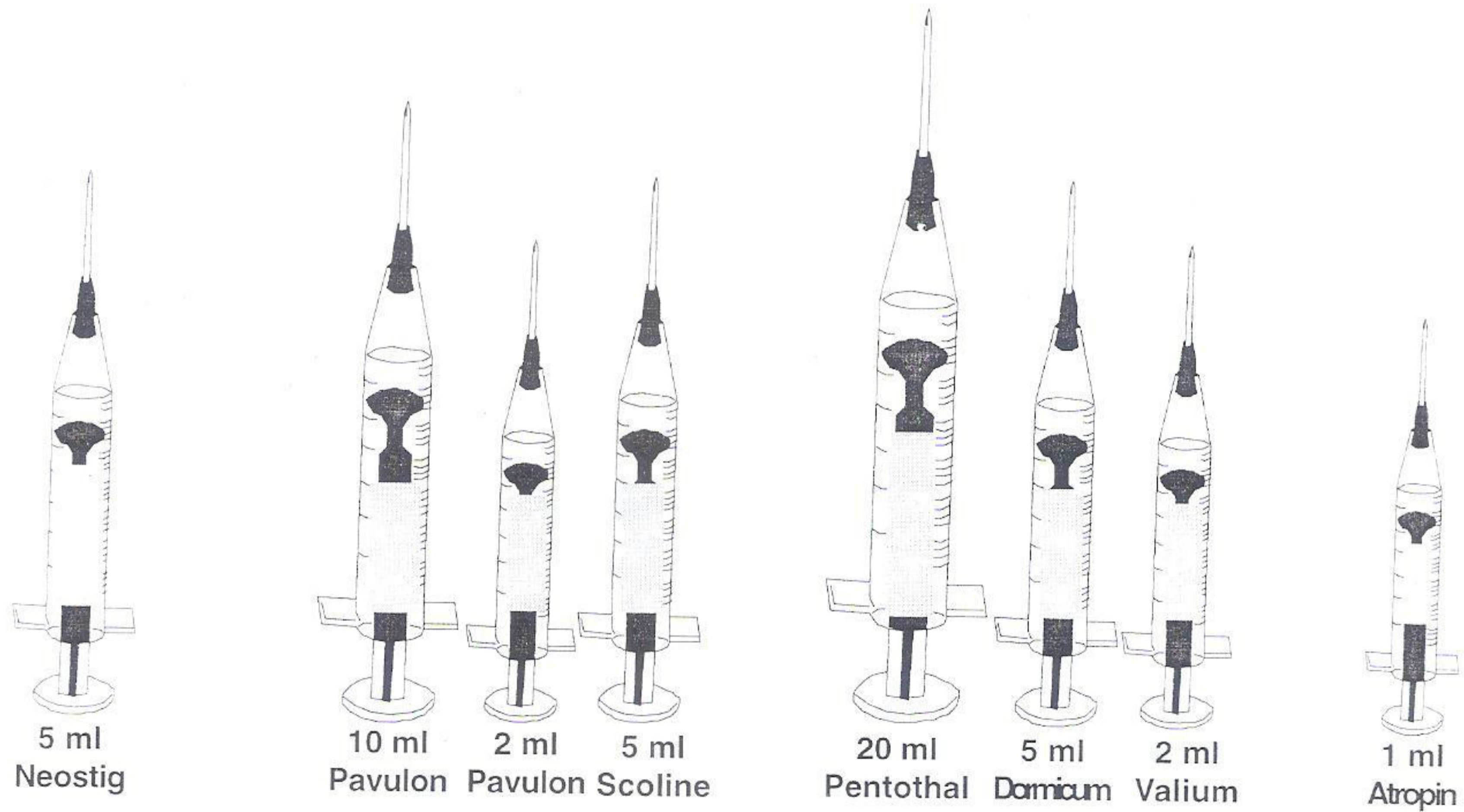
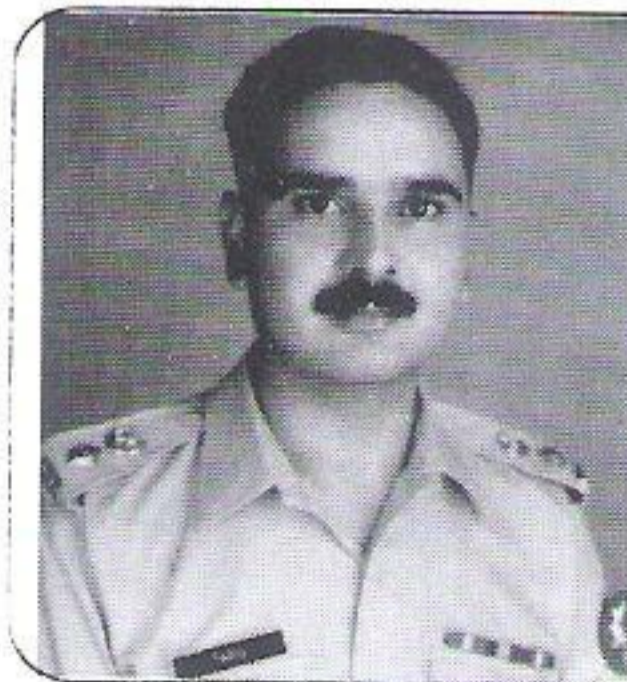


Fig. 5 Suggested layout plan of syringes on anaesthesia machine



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