

CHAPTER 6 – SUPPLY CHAIN

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Checklist:

- * How many anesthesia workrooms and how much space will be required?
- * Where will gas cylinders be stored?
- * How will medications be stored and distributed?
- * Where will bioengineering support be located?

It is not possible to devise a single plan for anesthesia support facilities appropriate for all healthcare facilities. Important considerations include available space, location, present needs, and future expansion. In larger facilities, more than one workroom may be required.

I. The Anesthesia Workroom

The precise location of the workroom should facilitate prompt serving of the each operating room/anesthetizing location, and will as such depend on the design of the operating suite, the location of the pharmacy and reprocessing areas. Proximity to recovery room and preoperative holding areas should also be taken into account. The size of the room will be determined by its function: whether primarily a storage facility or also the site of drug preparation, cleaning of equipment etc..

I.A. Storage

The anesthesia workroom should remain the main repository for anesthesia equipment and supplies. These should be stored in such a way that they can be easily found, not only by technicians but by all anesthesia personnel. This point is particularly crucial for out of hours use and in facilities with relatively sparse technician support. As such, grouping of equipment and supplies, and use of cabinets with transparent doors is recommended. A printed or computer-based location list, which lists items by various names that they might be called, is very helpful.

Removing items from shipping containers prior to arrival in the workroom will not only minimize crowding, but also avoid introduction of dust, contaminants, and pests to the area. Several small insects thrive in the corrugations of cardboard boxes.

I.A.1. Disposable Items

The quantity of disposable items in the workroom will depend upon the capacity and efficiency of other storage areas. If peripheral areas can hold and supply a large inventory of items on short notice, the quantity of such supplies in the workroom may be limited to that required for a few days. ‘Procedure-based delivery systems,’ in which supplies are packaged together for an entire case, increase efficiency.

I.A.2. Reusable Items

Storage space for depositing reusable items prior to cleaning and sterilizing may be provided in the workroom or in an adjacent area.

I.A.3 Other Equipment

Equipment that may be needed urgently, even if needed infrequently, should be kept in the workroom. There should be sufficient space and sufficient electrical outlets to allow for charging of transport monitors, infusion pumps, etc. Specific anesthesia carts – difficult airway, latex allergy, malignant

hyperthermia, those destined for 'off site' anesthesia, etc. – should be located in the workroom or in a designated nearby area.

1.B. Reprocessing

Decontamination of reusable equipment should not occur in places where clean equipment is stored. A separate area nearby should be provided, so that either the entire process of decontamination, cleaning, and resterilization can take place, or alternatively the initial decontamination and cleaning can occur before the items are transported to a central area for resterilization. Depending upon the size of the facility and other factors, the anesthesia reprocessing area may, or may not, be combined with the surgical reprocessing area.

The volume of work will obviously also depend on how much of the equipment in each facility is disposable, single use equipment versus how much is reusable – laryngoscope blades, laryngeal mask airways, bougies etc.

1.C Other Functions

In some facilities the workroom also provides space for paperwork (blank and completed anesthetic records, protocols, etc.); equipment manuals and logs; bulletin boards; mailboxes; and computers for E-mail, internet, and hospital information access.

II. Gas Storage

II.A. Cylinders

Cylinders of compressed oxygen, medical-grade air, and nitrous oxide need to be stored in close proximity to the operating room suite for use on anesthetic machines and for patient transport. Upright storage upright in a rack with wheels facilitates transfer to central supply for restocking. The area in which these are stored should be well-ventilated and organized in such a way to easily distinguish the full cylinders from the empty ones. Non-medical gases used in the facility should not be stored in the same location (e.g., acetylene). The number of cylinders stored should at least be sufficient in the event of pipeline oxygen failure. Many facilities store additional cylinders in case of natural or manmade disasters. A system for ensuring adequate supply of cylinders should be in place.

II.B. Liquid Oxygen

In some facilities, small portable liquid oxygen containers are used during patient transport. A large stationary container from which these may be filled may be housed in the main workroom or cylinder storage area.

III Drugs

Several systems of drug storage exist for operating suites. One that not only provides efficiency in procurement of medications for patient care, but also cost containment and control of abused drugs is essential. The model in which the anesthesia provider obtains controlled substances from the nursing staff is a common one, but it requires a considerably large stock of drugs to be stored in the OR suite. This model also risks inventory loss from expired medications and causes inefficient use of time and personnel in attempts to witness wastage.

Automated machines with password or biometric access can be used to dispense controlled drugs, other drugs, and needed anesthesia equipment. These machines may be located in each individual operating room and/or in a central area such as the anesthesia workroom. Charges to the patient can be recorded by the machine. The drawbacks include the expense and possible malfunction of the machine. Waste drugs may be returned to the machine, or witnessed wastage may still be required.

The use of controlled drug kits which contain a predetermined selection of opioids/benzodiazepines may also be used. In this case the anesthesia personnel would 'check out' a kit at the beginning of the day and record drugs and amounts received by each patient as well as witnessed wastage, before returning the kit to a dispensing machine/pharmacy/drop box/locked cupboard under the control of an operating suite staff – e.g. OR charge/recovery room nurse – at the end of their working day. The above systems will require considerable input from the main pharmacy, in terms of restocking, monitoring of expiration dates, user ID and password management, and supply of 'non standard' drugs (epidural infusions, vasoactive infusions etc.). This arrangement may require special licensing of personnel as dispensary pharmacies and may be legally complex.

A satellite pharmacy strategically located in the operating suite can help bypass some of the problems of drug handling in the operating room suite. Accounting for controlled substances may occur between anesthesia provider and pharmacist and thereby remove the need to involve others – usually a nurse or a physician. Medication requirements that arise during the case may be transmitted to the satellite pharmacist. In some cases the medications may need to be ordered from the main pharmacy, but the satellite may often represent a quicker, easier way to obtain them.

A satellite pharmacy will also be able to provide drugs required for the surgical procedure, and, depending upon the facility, may also be responsible for supply to the labor-and-delivery suite and for provision of off-site anesthesia. Accounting of medication, controlled and otherwise, matching use to patient for billing purposes, and surveying agents that are rarely used will be facilitated by centralizing this activity to one location. The arrangement for non-controlled substances – inhalational anesthetics, muscle relaxants, emergency drugs, etc. can vary widely. In one model, a used anesthesia drug tray is exchanged for a fresh one. The pharmacist inventories the used tray to determine what drugs were used and to generate patient charges. Different kinds of cases may require different anesthesia drug trays. Additional drugs may be supplied in automated machines or in the workroom. There should be a system in place for restocking trays and machines. There would need to be trays/kits prepared for off-hours use if the satellite pharmacy is not available at all times.

One can imagine a combined satellite pharmacy-anesthesia supply facility. Anesthesia providers would retrieve not only medications but also expensive disposables and expensive durable equipment from the same person in the same place.

IV. Biomedical Engineering Facilities

These may be at a site remote from, or be allocated in a space within, the operating room suite. If located in close proximity to the operating rooms, the engineering staff would be easily accessible to the OR personnel and would be able to respond promptly to concerns regarding equipment. This arrangement would also allow increased contact between engineers and anesthesia technicians and so promote greater efficiency in maintenance of equipment. While some 'simple' malfunctions may be handled by anesthesia technicians, there needs to be a clear delineation of which problems they may address and which should be referred to the engineering department. The drawbacks of having an engineering facility in the OR suite include isolation of the engineers from the rest of the biomedical staff, and deciding how much space is required. If equipment will be stored while awaiting repair or while awaiting shipment for repair, and if repair parts will be stored in the engineering area, a relatively large area will be required.

These facilities may also provide storage space for spare equipment that can be exchanged for malfunctioning equipment (e.g., monitors, anesthesia machines).

References:

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