Surgical Drains

Casey Holmes, MD
P. Geoff Vana, MD
Loyola University Chicago
Stritch School of Medicine
Department of Surgery

Created by: James S. Gregory, MD, FACS
ACS/ASE Medical Student
Simulation-based Surgical Skills Curriculum
Objectives & Goals

- Objectives
  - Learn how drains function
  - Learn the purpose of drains
  - Understand the types of drains
  - Learn the limitations of drains

- Goals:
  - Be able to assess drain functionality
  - Be able to identify the different types of drains by function.
  - Demonstrate the general steps in drain maintenance and removal
Surgical Drains

Section One: Theory of drain usage
Why do we drain?

Theoretical use:

A drain will prevent the accumulation of fluid or air that could serve to hinder healing, provide an environment favorable to bacteria, or result in the need for further surgery.

*The use of drains beyond this goal often results in less than satisfactory results!*
Why do we drain?

- To prevent build up of potential fluid or air which will hinder healing or lead to sepsis
  - In anticipation of a potential leak
    - Assumes the potential of the breakdown of tissue is likely or that such an occurrence would be disastrous!
    - Examples include pancreatic anastomosis, biliary anastomosis, & anastomosis in an inflammatory environment
  - In situations where fluid or air are expected consequences
    - Pneumothorax
    - Hemothorax
    - Large tissue flaps
What drains do not do?

- Drains are not placed to prevent infection or for bleeding!
  - Drains if left in for >7 days increase the risk of secondary infection
  - Blood will clot and plug drains
- Drains can not drain the entire abdomen
  - The human abdomen will wall off any drain within 48 hours
- Drains can not be relied on without maintenance.
  - Drains can give a false sense of security and should be carefully assessed for patency
Surgical Drains

Section Two: Types of Drains and Physics of function
Types of Drains: Overview

- **Passive**
  - Allow the build up of fluid or air a simple tract by which to exit

- **Suction**
  - **Closed**
    - Function by pulling fluid out of a cavity
    - They can develop excessive suction
  - **Sump**
    - Utilize a built in air port to keep the tissue from plugging the drain.

Examples:
- Foley
- Penrose
- Red rubber tube
- Pigtail
- Jackson Pratt®
- Blake®
- Chest Tube
- Nasogastric Tube
- Duval – Abrahamson®
- Axiom®
Physics of Drain Function
Passive Drains

- Rely *solely* on gravity, pressure or surface tension to eliminate the fluid or air
- Provide a simple path for drainage
- Can be overcome by large volumes of output or a high rate of smaller volumes
- Can easily become blocked by tissue or thick fluid
- Any drain type can function passively
Physics of Drain Function
Suction Drains

- Still depend on gravity but actively pull on any accumulated fluid or air
- The strength of the suction must be adjusted to not pull the surrounding tissue into the drain and plug it
- Can potentiate continued leakage by facilitating flow.
- The addition of an air port allows air to be pulled into the tube to help prevent the development of excessive suction and tissue intussusceptions into the drain
- In some drains a third port is added to allow irrigation of the drain: This serves to help keep the drain patent
Examples of Drains: Closed Suction Types

- Nasogastric sump type tube: Blue port is the air port.

Two types of closed drains: one fluted and one with simple holes. The fluting decreases clogging but may limit suction.
Examples of Drains: Passive Types

**Mallencot style partially closed tip catheters** to maintain flow and decrease clogging

**Red rubber style closed tip catheters** with side drainage holes (can occlude easily)
Examples of Drains: in Patients

Penrose: purely a passive drain. Shown here draining a large lap type laceration.

Pigtail: placed per-cutaneously maybe used passively or on suction. Shown here draining a pelvic fluid collection.
Drain Selection

Basic guidelines

• Suction
  – Desire to keep the cavity collapsed
  – Need to rapidly remove the fluid or air
  – Large amount of drainage expected

• Passive
  – Just need to keep the tract open
  – Draining a natural hollow cavity (bowel, bladder, chest)
  – High risk of tissue damage by suction

Although these rules are the general guidelines used for choosing drains, research suggests that in many cases they are equivalent.
Drain Placement: General Guidelines

- Place the drain in the most dependent part where the fluid or air is likely to accumulate
- Assure as straight as possible to the outside
- Secure the drain in place
- Assure the drain is not laying in such a way as to promote:
  - migration or
  - erosion into adjacent tissue

Get It Right the First Time! Repositioning often difficult or impossible afterwards!
Because of the lordotic curve of the spine and the psoas, the shape of the abdomen in coronal and transverse sections resembles a dumbbell. Fluid accumulates at the end of the dumbbell in dependent areas: Pelvis, retro hepatic/splenic and in the colonic gutters. (RED)
Drain Placement
Gravity & Anatomy
Drains must be placed in these dependant areas to be effective!
Drain management
Things to Check For: Daily

- **Patency**
  - watch for sudden decreases in output
  - check connections & bulb/suction for function
    - Is the system intact
    - Lack of suction may cause drain to malfunction
  - Empty collection container when ½ to ¾ full
    - Maintains suction
    - Avoids overflow

- **Character of Drainage**
  - Sudden presence of blood may indicate drain erosion into tissue
  - Sudden change in the color of the drainage may indicate a fistula or abscess
Drain management
Things to Check For:

• Sumping Function
  • Do you hear air moving?
    – The suction may be injuring the tissue
    – The suction may be ineffective
  • Is there fluid in the air port”
    – The tube may be plugged or kinked
    – There may be excessive fluid build-up beyond the capacity of the drain.
Drain Management: Suction Devices

- Bulb & reservoir suction collection device: Requires manual compression to function in suction mode.
- Inactive suction: passive drainage only.
- Compressed and active.
Drain management
Removal: general guidelines

Drains are removed:

– When they are no longer needed
  • Drainage has stopped
  • Drainage has reached an acceptable level

– When the risk benefit ratio is exceeded
  • Risk of secondary infection
  • Possible tissue erosion

– When they are non-functional
Drain management
Removal: Technique

**Essential common steps:**
1. Inform the patient of your plan
2. Have dressings available
3. Take any suction drains OFF suction
4. In the case of pigtail drains: Cut the pigtail internal suture (found at the end of the catheter) FIRST
5. Cut the anchoring suture if one exists
6. Pull firmly and slowly
7. STOP if increased resistance is encountered.

Consult the references enclosed for tube specific guidelines. However recognize that there is significant “art” to drain removal timing and that the clinical judgment of the surgeon must be considered!
References


7. Drowning in Drainage: The Liverpool hospital guide to drains and tubes http://www.surgicaldrains.com