

Direct Peritoneal Resuscitation

Background, including pathophysiology

The advent of damage control surgery (DCS) has led to a staged approach to the patient in extremis with intra-abdominal hemorrhage and shock that has undoubtedly saved lives. However, massive resuscitation associated with severe hemorrhagic shock involves fluid administration in volumes far in excess of estimated blood loss because of the shift of fluid from the intravascular to the extravascular space. This massive volume load usually results in substantial tissue edema, which can delay abdominal closure.^{9,10} Acute tissue edema with swelling of the interstitial space secondary to resuscitation is a dominant factor in the inability to close many DCS patients.

Direct peritoneal resuscitation (DPR) is a validated resuscitation strategy in patients with open abdominal wounds. The practice consists of suffusing the peritoneal cavity with a 2.5% glucose-based peritoneal dialysis solution along with traditional intravenous resuscitation. The process leads to microvascular vasodilation and increases visceral and hepatic blood flow¹; reverses endothelial cell dysfunction²; improves survival and down regulates the inflammatory response³; reverses established microvascular constriction⁴; normalizes capillary perfusion density⁵; and normalizes systemic water compartments⁶; preserves hepatic blood flow improving survival and preventing hepatic inflammation following hemorrhagic shock⁷; improves obesity-induced hepatic dysfunction after trauma⁸; accelerates primary abdominal wall closure after damage control surgery and prevents complications associated with open abdomen^{9, 10}. In addition to observed effects on microcirculation, it has marked ability to decrease visceral edema and normalize body water ratios. In the pediatric population, it has been shown to augment ideal blood flow in necrotizing enterocolitis¹¹. The technique improves inflammation, liver blood flow, and pulmonary edema in brain death¹². The technique has been demonstrated safe and effective in humans with no untoward physiologic events or complications^{9, 10}.

Goals of therapy

The goal of Direct Peritoneal Resuscitation is to decrease organ dysfunction, decrease intra-peritoneal inflammatory response, decrease or prevent complications associated with damage control surgery and planned open abdomens and help facilitate early abdominal closure.

The ultimate goal is that patients receiving direct peritoneal resuscitation will achieve significant reduction in time to abdominal closure, decreased number of re-exploration operations as well as higher rate of primary fascial closure.

Indications and Contraindications

Direct Peritoneal Resuscitation is indicated in the treatment of patients with planned open abdomen after damage control surgical procedures where the surgeon is unable to achieve primary fascial closure or in situations where is inadvisable to attempt primary abdominal closure due to planned re-operation, significant peritoneal contamination or inflammation, need to second look due to bowel viability, or other indications. Its use requires the fascia to remain open, with peritoneal contents and fluid controlled ideally with a commercial system such as the Abthera wound vac. However, other temporary abdominal closure strategies are also acceptable as long as

they support a system for controlled abdominal fluid affluent.

Contraindications are closed abdominal wall or inability to adequately remove infused peritoneal fluid.

Technique- Equipment and set up with pictures

Operative phase

Surgeon performing procedure places drain prior to temporary abdominal closure. Ideally this will involve a standard 19fr round 'Blake' type drain placed around the root of the mesentery, though other alternative drains with leur-lock adaptors are acceptable. The Blake drain will have a Medtronic DLP 3mm vascular cannula attached, secured in place with surgical ties (tie several tight silks around the end of the Blake) as needed to ensure watertight connection.





Once in place – the vessel cannula will be capped with a standard IV tubing cap.

Of note- an alternative to the DLP vascular cannula is the following catheter adapter with the Christmas tree on one side and leur lok on the other. These may be more accessible in SICU if for some reason the vascular cannula was not added or available. There were previous reports of leakage but has since been tested and none leak as long as you secure them in there as tight as humanly possible.



ICU

Once the patient arrives in the ICU – the nurse will confirm the order for Direct Peritoneal Resuscitation. A 5000 ml bag Delflex 2.5% peritoneal dialysis solution, will be obtained from pharmacy along with an Alaris IV pump on a separate IV pole and standard Alaris IV tubing. The Alaris IV pump, IV tubing and DPR catheter should be clearly marked “FOR DPR USE, NOT FOR IV INFUSION”.



After ensuring proper function of the temporary abdominal closure device, the DPR IV pump and tubing is connected to the DPR catheter and the infusion initiated at the ordered rate. It should be labeled “DPR only, do not inject” as per the One Chart order.

The infusion is continued until the order is discontinued by the surgical service or the patient is returned to the operative room for abdominal re-exploration. It is acceptable to hook up the Abthera or temporary wound closure to wall suction (at a setting of less than 120 mmHg), but patients should have a KCI VAC unit at bedside as an alternative if needed for fluid removal. Canisters on the temporary abdominal closure device are changed as needed, anticipating that approximately 500cc of fluid will be evacuated from the peritoneal cavity per hour. If using wall suction, the Abthera tubing fits directly into suction tubing and can be secured with tape or tegederm.

Administration/management

ADMINISTRATION:

1. Follow standard steps for nursing procedures.
2. Obtain 5000ml bag of 2.5% Delflex peritoneal dialysis solution from pharmacy.
3. Prime standard Alaris pump IV tubing with solution. For safety, all Direct Peritoneal Dialysis should be infused using an independent Alaris pump separate from all other infusions. Tubing should be labeled to distinguish it from IV infusions and should be reviewed during bedside shift report.
4. To set up, the red frangible pin on the 5L bag should be broken. The bag is connected to IV tubing as usual. The patient should have an abdominal drain in place for infusion. The tubing is connected to the DPR drain using Medtronic 3mm Vascular catheter or other catheter with a leur lock connection. If the connector is not present, the operating physician should be contacted as this is a unique connection device. Insert the “christmas tree” end of the connector into the Blake drain and connect the pump tubing using the leur lock end.
5. Program pump according to administration instructions in ACP orders. RN should expect orders for 500ml bolus, then continue infusion at a rate of 1.5ml/kg/hr until AbThera would vac is removed or orders are discontinued. A new bag of Delflex solution should be used every 24 hours while resuscitation is ongoing.
6. The dialysate must be on a separate pole and pump.

7. Label the Blake drain most distal from the site indicating the type of drain.
8. Label the fluid tubing most distal from the bag with type of fluid.
9. The solution will automatically circulate in the peritoneal cavity and be evacuated through the negative pressure AbThera wound vacuum, either to the VAC canister or wall suction <120 mmHg.
10. DPR solution infused should be recorded as “input” by the Registered Nurse in the patient’s EHR in the row for the Abdominal Drain DPR and wound vac output should be included as “output” in the medical record under the row included with the LDA for the incision.
11. **Change** wound vac containers as needed. **STOP** the DPR infusion anytime the wound vac is not running/functioning for more than a short period of time.
12. **NEVER** clamp the wound vac tubing while the infusions are running. If you need to trouble shoot the wound vac, **STOP** the DPR infusion pump until wound vac is functioning. Contact the surgical team for assistance as needed.

Ordering/order sets

See flier for order set details. Please note the rates of infusion for the initial bolus and maintenance rates should not be adjusted.

Ins and outs will be recorded as shown in the flier also.

Complications and concerns

Inadequate removal of peritoneal fluid leading to potential increased intra-abdominal pressure, intra-abdominal hypertension and potential abdominal compartment syndrome.

Leakage of dialysate from instillation or evacuation process due to improper/inadequate set-up.

If either of the above is a concern, stop the infusion, call the provider. Do not stop the suction on the VAC or wall.

Authors

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