What are the special advantages of "final filters in IV therapy? Should they be used routinely or under any special circumstances?

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The value of in-line blood filters for certain banked red blood cell products is better established [Lancet 1:189, 1976] and will not be considered in this discussion.

In-line membrane filters placed terminally, between the IV catheter and the administration set tubing, have been advocated to reduce the risk of sepsis from contaminated intravenous (IV) fluids and protect patients from particulate matter.

Contamination of IV fluid is now a well-established fact. Approximately 2-10% of in-use infusions randomly sampled in the hospital contain microorganisms, usually in very low concentrations (less than one per ml) of minimally pathogenic bacteria (predominantly Staphylococcus epidermidis, Bacillus sp. and diphtheroids). Most contamination appears to be of extrinsic origin, related to the many manipulations that occur in the course of IV therapy. The presence of contamination is directly related to the duration of uninterrupted infusion: delivery systems in continuous use more than 24 hours are much more likely to contain organisms than those in use for shorter periods.

Moreover, fluid can also be contaminated—fortunately, rarely—by organisms that have been introduced during manufacture; as evidenced by two nationwide outbreaks in the U.S. and two episodes in Great Britain since 1970.

The occasional presence of those few species capable of rapid proliferation in glucose-containing solutions (reaching concentrations of more than 100,000 organisms/ml within 24 hours), primarily Klebsiella, Enterobacter, Serratia, and Pseudomonas cepaciae, obviously poses the greatest medical hazard. Recognizing the cumulative nature of in-use contamination of IV fluid and the explosive growth potential of certain microorganisms, the simplest measure to reduce the incidence and impact of contamination is to routinely change all bottles or bags and delivery apparatus every 24-48 hours, and at each cannula relocation to totally replace all IV equipment.

Routine use of in-line microfilters theoretically would also appear to be an effective means of protection against fluid contamination. Filters are available in a wide variety of sizes but 0.22 and 0.45-micron pore size are most commonly used for IV therapy. The 0.45-micron filter prevents the passage of fungi and most bacteria although Pseudomonas sp., E. coli, and other Gram-negative bacilli begin to pass through the filter within 6 hours of continuous use. The 0.22-micron filter blocks virtually all bacteria; however, an infusion pump is required.

Filters, particularly the 0.22-micron size, significantly impede the rate of fluid flow and have an irritating tendency to become blocked, particularly when used for periods beyond 24 hours or if air bubbles get into the line. (Very recent technological advances which have expanded the filter area and incorporated means for venting air bubbles from the system may substantially reduce this tendency, but the new filters will be quite expensive.) With highly viscous solutions, such as for total parenteral nutrition, pumps are usually necessary to ensure uninterrupted flow.

Filters should reduce the hazard of infection arising from contamination of fluids during manufacture and reduce the risk of infection from contaminants introduced above the filter in the course of IV therapy. However, they have no effect on organisms gaining access to fluid at points below the filter and do not prevent the passage of endotoxin. Although filters are promising on a theoretical basis, no controlled studies have
been reported in a sufficiently large population to assess their efficacy in prevention of sepsis. Moreover, the manual manipulation of the delivery system needed to install the filter for use imposes one more opportunity for extrinsic contamination (although incorporation of filters into the system during manufacture could obviate this hazard). More disconcerting is the filters' tendencies to become blocked as blockage inevitably leads to added manipulations of the cannula and delivery system in attempts to identify the cause of malfunction.

A recent, uncontrolled study found a 4-fold increased risk of sepsis in patients receiving total parenteral nutrition through in-line filters as compared to a group in which filters were not used. The medical center at which this study was carried out did not have a full-time IV team or use infusion pumps. The markedly increased incidence of infections in the filter group was attributed to the increased number of manipulations of the IV system by ward personnel following filter blockage. A number of institutions do not utilize filters for total parenteral nutrition and have not noted higher rates of infection. A recent controlled study in Great Britain found no significant differences in infection phlebitis or infection in filter and non-filter groups of patients receiving conventional IV therapy.

One group of investigators in a well-controlled study showed a marked reduction in infusion phlebitis in patients whose infusion systems contained in-line filters. However, this observation has not yet been corroborated by other groups and the efficacy of in-line filters in prevention of phlebitis remains to be confirmed.

Commercial solutions, and particularly drug additives, for intravenous infusion commonly contain from several hundred to thousands of particles of foreign materials including fibers, aggregated drug, inert filler and crystalloid, glass, metal and rubber fragments, and other incompletely characterized matter. Such particulates are known to cause granulomas in the lungs of recipients of large volumes of parenteral solution and may, although this has not been proven, contribute to pulmonary hypertension and other serious lung lesions. Filters may well prove to be of greatest benefit for the removal of particulate matter, especially if such materials are conclusively linked to clinical disease. The practice of many pharmacies to routinely filter—before delivery to the patient-care unit—those products most frequently contaminated by particulate matter seems justified.

A final consideration is the fact that filters are expensive, costing from $.50 to $1.50 per patient. If replaced daily, as is currently recommended by many authorities and manufacturers, the filters substantially increase the cost of IV therapy.

In summary, the potential value of in-line filters in reducing the incidence of infections related to contaminated IV fluid is recognized. However, clinical trials to verify their efficacy and to demonstrate a cost-benefit advantage are greatly needed. Filters may prove to be of greatest value in removing potentially hazardous particulate matter and possibly of value in reducing infusion phlebitis. Until data based on additional studies become available, no recommendation for the routine use of filters can be forthcoming, although, in my opinion, use of less expensive microfilters in the hospital pharmacy is justified. If an IV team and infusion pumps are available, in-line filters may have a place in total parenteral nutrition. At the present time, routine replacement of all delivery apparatus every 24 hours probably provides equivalent protection against infection caused by contaminated fluids.

References:

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WOUND AND SKIN PRECAUTIONS

To what extent must "wound and skin precautions" be followed in patients with minor post-operative infections? Of course, in patients with sizable wounds, in which there is obvious and extensive drainage, the full gamut of skin and wound precautions are put into effect. However, neither we nor anyone else has talked with differentiate between these obviously serious post-operative wound infections and the much.