

or decreases of intraocular pressure, independent of general vascular changes. Decreases in intraocular pressure are probably sympathetically mediated since they can be prevented by section of the sympathetic trunk. Stimulation of the peripheral end of cut cervical sympathetic trunk causes constriction of ciliary vessels and is associated with a marked decrease of intraocular pressure.⁶

Armaly* observed a decrease in intraocular pressure following stimulation of the parasympathetic root of the ciliary ganglion, prob-

ably reflecting a decrease in ciliary blood volume.

In summary, while most anesthetic agents have been shown to lower intraocular pressure, nitrous oxide being the only possible exception,^{3,12} the present study shows that ketamine in clinically used doses, administered to a premedicated patient, has no significant effect on intraocular pressure.

The authors thank Doctor Don Turner, Department of Surgery, for his help in statistical preparation of this paper.

Fine-screen Filtration of Pressurized Whole Blood, Packed Cells, and Fresh-frozen Erythrocytes

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Fine-screen filtration removes particulate matter in stored blood, thereby alleviating a potential cause of respiratory failure following massive transfusion.¹ Previously, we reported² that fine-screen filtration: 1) need not interfere with flow rate of blood compared with the control (170-micron) filter; 2) removes twice as much debris as the control filter; 3) reduces screen filtration pressure (a measure of debris removal); 4) does not harm fresh whole blood infused by gravity. However, the clinical requirements of transfusion therapy demand

that blood be pressurized to achieve rapid infusion through fine-screen filters or blood warmers, or when a massive blood loss is encountered. Concern that fine-screen filters affect erythrocytic integrity when blood is pressurized to 300 torr has been voiced. Therefore, we determined the hemolytic effect on erythrocytes of infusing whole blood, packed cells, and fresh-frozen erythrocytes at 300-torr pressure.

METHODS

Ten units each of indated whole blood, packed erythrocytes, and fresh-frozen erythrocytes (FFE) were infused at 300-torr pressure through a 40-micron woven knit filter. The erythrocyte count, hematocrit, and plasma free hemoglobin were measured before and after filtration. Screen filtration pressure (SFP) was measured in 4 units of FFE before and after filtration by the method of Swank.³ The 20-micron screen used in the measurement of SFP was fixed in 1 per cent glutaraldehyde solution, after which electron micrographs were made. To avoid damage to the transducer during measurement of SFP before the FFE were filtered, the SFP

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Received from the laboratories of the Department of Anaesthesia, Harvard Medical School at the Massachusetts General Hospital, Boston, Massachusetts 02114. Accepted for publication May 3, 1975. Supported in part by Harvard Anaesthesia Center Grant GM15904-08.

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TABLE 1. Effects of Ultrafiltration at 300-torr Pressure on Blood Constituents and Screen Filtration Pressures of Indated Blood Components

| | Whole Blood | | Packed Cells | | Fresh-frozen Erythrocytes | |
|-------------------------------------|-------------------|------------------|-------------------|------------------|---------------------------|---------------------|
| | Before Filtration | After Filtration | Before Filtration | After Filtration | Before Filtration | After Filtration |
| Erythrocyte count ($\times 10^6$) | 4.2 ± 0.1 | 4.4 ± 0.2 | 7.1 ± 0.4 | 6.8 ± 0.3 | 8.4 ± 0.3 | 8.4 ± 0.3 |
| Hematocrit (per cent) | 37 ± 1 | 39 ± 1.4 | 63 ± 3 | 60 ± 3 | 74 ± 2 | 73 ± 2 |
| Free hemoglobin (mg/100 ml) | 46 ± 10 | 43 ± 9 | 479 ± 139 | 381 ± 136 | 1,152 ± 182 | 1,158 ± 191 |
| Screen filtration pressure (torr) | — | — | — | — | 13,550 $\pm 2,509$ | 188.5 ± 46.6 |

machine was turned off after $\frac{1}{4}$ second, because SFP went off scale (0–400 torr). After filtration of FFE, the full 10 seconds were used to determine SFP. Thus, the pre-filtration screen examined by electron microscopy was exposed to erythrocytes for only $\frac{1}{4}$ second, whereas the post-filtration screen was exposed for the full 10 seconds.

RESULTS

The results are summarized in table 1. Erythrocyte count, hematocrit, and plasma free hemoglobin were the same before and after filtration of indated whole blood, packed cells, or FFE. The SFP in FFE extrapolated to 13,550 torr prior to filtration and decreased to 188 ± 49 torr following filtration. Electron micrographs of the prefiltration screen show massive accumulation of erythrocytes on the screen compared with erythrocyte accumulation on the screen after filtration (fig. 1).

DISCUSSION

Infusing indated whole blood, packed cells, and FFE through a fine-screen filter at 300-torr pressure did not alter erythrocyte measurements, suggesting that erythrocytes were unharmed by fine-screen filtration. We have previously shown a manyfold reduction in SFP when outdated whole blood was filtered

through a fine-screen filter, and now report an equally large change with FFE.

By our relatively crude tests of hemolysis, even the most fragile erythrocytes, namely FFE, filtered at 300-torr pressure did not hemolyze sufficiently to change plasma free hemoglobin. Erythrocytic hemolysis has been of concern to those interested in fine-filtration methods because high pressures are required for infusion. Those patients at risk from the pulmonary effects of massive transfusion are the same patients at risk from hypovolemia when a massive transfusion is needed. We believe that infusing whole blood, packed cells, or FFE under pressure can be accomplished at the same flow rate as control (170-micron filter)² without inducing hemolysis of erythrocytes. Furthermore, erythrocyte fragility is not affected by filtration,⁴ and erythrocyte survival times are only slightly but significantly reduced when 14-day-old dog blood is infused through a 40-micron screen filter.¹

An area of concern unrelated to filtration was the high plasma free hemoglobin level found in FFE. The amount of plasma in 1 unit of FFE averages 33.7 ml, hence the total amount of infused hemoglobin is small.⁵ Furthermore, stroma-free hemoglobin is not hazardous to renal function, and is easily passed through the renal tubules and excreted.

¹ Gervin, AS, personal communication.

⁵ Huggins, CE, personal communication.

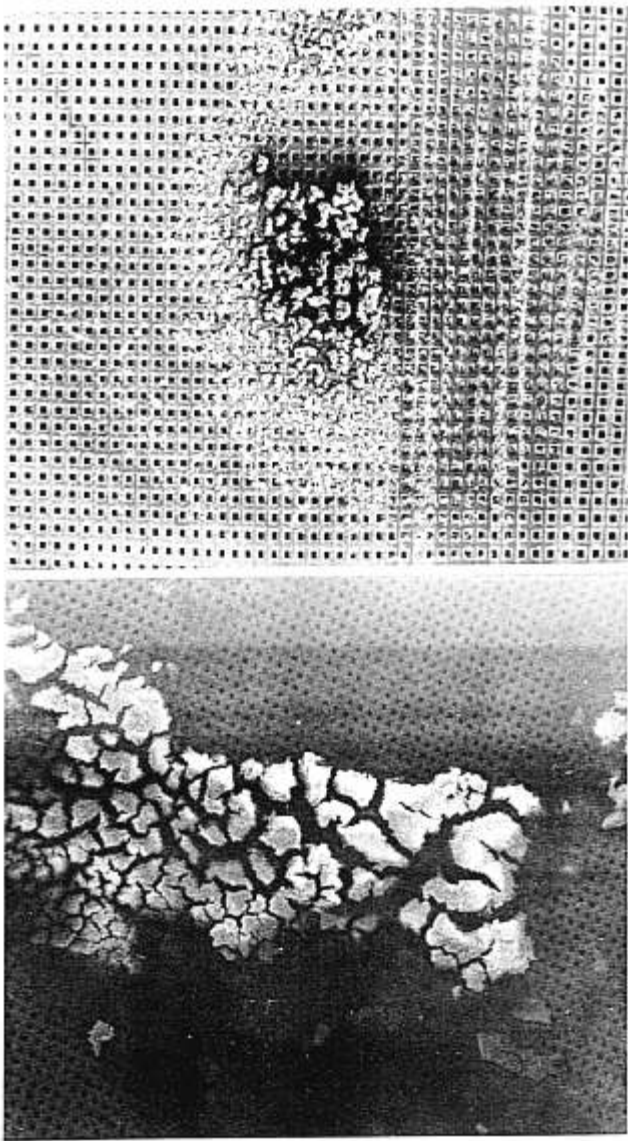


FIG. 1. Electron micrographs of the 20-micron screen mesh used to measure screen filtration pressure are shown at $\times 56$ (reduced from $\times 60$). The mesh was exposed to the fresh-frozen erythrocytes for only $\frac{1}{4}$ second. The mesh was exposed to the fresh-frozen erythrocytes for 10 seconds.

This study confirms our previous suggestion that fine-screen filters are efficacious, safe, practical, and should be routinely used when transfusion of more than two units is anticipated.

The authors thank Dr. Bryan Marshall, Professor, Department of Anesthesia, Hospital of the University of Pennsylvania, for preparation of the electron micrographs, and Dr. Charles Huggins and Mr. Michael Seiler, Blood Bank, Massachusetts General Hospital, for measurements of free hemoglobin levels.

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Epidermolysis Bullosa Manifested and Treated during Anesthesia

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On occasion, the anesthesiologist, starting an apparently uncomplicated anesthesia, suddenly faces an unexpected life-threatening emergency completely unrelated to the surgical problem. Insufficient information as to the patient's prior medical history is often the cause.

Epidermolysis bullosa was first reported by Koebner in 1886. It is a chronic, non-inflammatory hereditary disease involving the skin and mucous membranes. Lesions are common on the lower extremities, especially the feet, but the hands may also be involved. Least commonly involved is the oral mucous membrane. Lesions consist of bullae, ranging from a few millimeters to several centimeters in size, with or without surrounding erythematous areas. These bullae contain sterile fluid and rupture to form shallow ulcerations.

Epidermolysis bullosa is of two types, simplex and dystrophic. The dystrophic type is classified as dominant or recessive based on autosomal inheritance. Oral lesions are commoner in the dystrophic type, particularly

the recessive form. When present, they are most common in the buccal mucosa and the tongue, followed by the lips, gums, and palate in order of frequency. Oral lesions may manifest as a combination of bullae, infiltrated areas, erosions, or patches of leukoplakia. Impaired motility of the tongue and microstoma has been reported, a result of recurrent lesions that heal with the formation of considerable cicatricial tissue.

These lesions may have their onset soon after birth when the infant starts feeding, or they may be delayed for months or even years. The disease is believed to result from loss of the intercellular bridge, resulting in separation of cells, accumulation of edema fluid, and bulla formation. Eruption is known to occur after stress, trauma, allergic reactions, drug sensitivity, or infection.

REPORT OF A CASE

A 60-year-old man weighing 77 kg was admitted the day before a scheduled cataract extraction. His only previous operation, at the age of 40 years, had been an extensive dental reconstruction, completed without complication. Three years prior to this admission, oral bullae that caused difficulty in chewing had developed. A diagnosis of epidermolysis bullosa had been made and the patient treated with steroids for three months. Complete remission occurred, and the patient had since been asymptomatic.

Physical examination revealed that the patient was obese and plethoric, with extensive dental

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Accepted for publication May 18, 1975.

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