Plasmapheresis in the Tokai University Medical Center, 1983--1989

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(Received November 8, 1991; Accepted April 9, 1992)

There were 634 instances of plasmapheresis performed on 152 patients in the Kidney Center, Tokai University Hospital, in the seven year period from Jan. 1983 to Dec. 1989.

The average number of plasmapheresis treatments per patient was highest for those with neurological and dermatological disease (6.7), followed by liver disease (5.6), and drug intoxication (1.2).

The major treatment modalities for the liver, collagen, drug intoxication, hematologic, neurologic and hyperlipidemic disorders were plasma exchange (PE) and double filter plasmapheresis (DFPP). Recently, however, the use of plasma perfusion (PP) and immunoadsorbent plasma perfusion (IPP) has been increasing because of their ability to selectively adsorb various pathologic macromolecules.

(Key Words: plasmapheresis, plasma exchange (PE), double filter plasmapheresis (DFPP), Plasmaperfusion (PP), immunoadsorbent plasmaperfusion (IPP)

INTRODUCTION

The technology of membrane plasma separation is well established, with the goal of on-line plasma treatment being to minimize the removal of essential plasma constituents while eliminating pathologic substances.

Therapeutic plasmapheresis has played a major role in the treatment of certain intractable diseases and in investigating their etiology. In recent years, many reports have appeared concerning the effectiveness of plasmapheresis in patients with various autoimmune diseases.

This paper reports our experience with the plasmapheresis of 152 patients with various diseases, using membrane plasma separation filters.

PATIENTS AND METHODS

The patients were treated by plasmapheresis in the Kidney Center, Tokai University Hospital, during the seven year period from 1983 through 1989. Our observations consist of 634 occasions of plasmapheresis, on 152 patients, and encompass pathology, times of plasmapheresis, and treatment modalities.

RESULTS

1. Number and category of patients undergoing plasmapheresis

Fig. 1 lists the top seven diagnoses and the number of patients. The most prominent disorder was liver disease (51.6%), followed by collagen disease (20.4%), drug intoxication (16.4%), hematological disease (11.8%), neurological disease (7.9%), hyperlipidemia (5.9%) and dermatological disease (2.0%).

2. Number of treatments

Fig. 2 shows the number of occasions plasmapheresis was performed for the several disease categories. A total of 270 (42.5%) was for liver disease; 112 (17.7%) for collagen disease; 31 (4.9%) for drug intoxications; 67 (10.5%) for hematologic disease; 80 (12.6%) for neurologic disease; 34 (5.4%) for hyper-
lupus erythematosus; 110 (17.7%) for collagen disease; 3 (4.9%) for drug intoxication; 50 (7.9%) for hematological disease; 80 (12.9%) for neurological disease; 34 (5.4%) for hyperlipidemia; and 20 (3.2%) for dermatological disease.

3. Mean number of treatments per patient

Fig. 3 shows the mean number of times of plasmapheresis per patient per disease category. Overall, the average number of plasmapheresis treatments per patient was 4.2. For the neurologic and dermatologic diseases, the mean was 6.7 times; 5.6 times for liver disease; 3.8 times for hyperlipidemia; and 2.0 times for other diseases.
4. Number of times the various treatment modalities were used.

Fig. 4 shows the total number of treatments for each treatment modality. Plasma exchange (PE), using the plasma separator, was the most common (49.4%); followed by double filter plasmapheresis (DFPP), using a plasma separator (first filter) and plasma fractionator (second filter) 36.2%; plasmapheresis (PP), using a sorbent column (9.8%); and immunoabsorbent plasmapheresis (IPP), using an immunoabsorbent column, (4.6%).

5. Number of times plasmapheresis was performed on an annual basis

1) Liver disease

Fig. 5 shows the annual number of plasmapheresis procedures performed for liver disease. The total number of patients increased modestly from four in 1983 to 11 in 1985, but after that decreased slightly.

The major treatment modality for liver...
disease was PE. The mean number of times of PE per patient increased from 3.9 in 1983 to 8.6 in 1986, and then decreased. In contrast, plasmapheresis increased suddenly in 1988.

2) Collagen disease

Fig. 6 lists the annual statistics for collagen disease. There was only one case in 1983, but after that, the number of patients requiring plasmapheresis has remained at 4–8 per year. The major treatment modality for collagen disease was DFPP and was performed per patient 3–4 times. Since 1987, IPP using immunoadsorbent columns has increased.

3) Drug intoxication

Fig. 7 shows annual number of plasmapheresis procedures for drug intoxication.

Since 1986, the number of patients that required plasmapheresis has remained at 5–8 per year. The major treatment modality for drug intoxication was PE until 1988. In 1989, PE and PP achieved the same frequency.

The number of times of plasmapheresis was 1–2 per patient.

4) Hematologic disease

Fig. 8 shows the annual number of plasmapheresis procedures for hematologic disease. During 1988 and 1989, the number of patients requiring plasmapheresis has been five. The major treatment modality was DFPP, performed 2–3 times per year per patient.

5) Neurologic disease

Fig. 9 lists the number of plasmapheresis procedures performed annually for neurologic diseases.

The number of patients requiring plasmapheresis has remained at 1–3 patients per year. The major treatment modality for neurologic disease was DFPP, with the number of times of plasmapheresis per patient varying yearly.

6) Hyperlipidemia

Fig. 10 shows the annual number of plasmapheresis procedures performed for hyperlipidemia.
Fig. 6 Annual number of plasmapheresis procedures performed for collagen disease

Fig. 7 Annual number of plasmapheresis procedures performed for drug intoxication
Fig. 8 Annual number of plasmapheresis procedures performed for hematological disease

Fig. 9 Annual number of plasmapheresis procedures performed for neurological disease
Some 1–3 patients required plasmapheresis every year with the major treatment modality being DFPP until 1986.

In the succeeding years, PP increased and by 1989 was performed more frequently than DFPP.

**DISCUSSION**

Plasma exchange therapy causes the loss of required plasma components as well as removing pathogenic substances.

In Japan, the first clinically useful membrane plasma separator was described by Inoue et al (8) in 1978. Soon afterwards, DFPP or cascade filtration, was devised in an attempt to reduce the amount of replacement or supplementation fluid by removing selectively pathologic substances from the blood. The concept of DFPP, first reported by Agishii et al in 1979 (1, 2), is presently very popular in Japan and has been used in the treatment of various intractable diseases.

In 1980, Gurland's (4) and Sieberth's (6) group reported in their cascade filtration studies and, Malchesky and Nose presented the procedure of cryofiltration (11). In 1985, thermodiffusion was described by Nose et al (12).

Plasmapheresis has been widely applied for immunological disorders, liver diseases and a variety of intractable disease over short periods of time without major problems (3, 5, 6, 9, 19). Indeed, the safety and reliability of plasmapheresis have been emphasized by many investigators.

In this study, the most prominent group of disorders that required plasmapheresis was liver disease, which in the report of the Japanese Registry (15), was ranked second to the collagen diseases.

The total number of PE patients with liver disease and the mean number of times of PE per patient rose gradually until 1985 at which time a decrease was noted. The reason for this decrease may be reexamination of the effect of,
and indication for, PE in liver disease. The number of days to death after the onset of hepatic encephalopathy, although increased in hepatic failure patients treated by PE, could not be correlated with a lasting improvement in the level of consciousness.

After 1987, the clinical application of new bilirubin adsorbent materials gained popularity. Ion-exchange resins formed of styrene divinylbenzene (BR-350, Asahi Medical Co. Ltd) (10) and charcoal plasma perfusion columns (N-350, Asahi Medical Co. Ltd) (7) were used. BR-350 and N-350 each have specific affinities to bilirubin and aromatic amino acids, respectively, and the serial application of these adsorbent materials is effective in the management of hepatic failure and especially so with hepatic coma.

Plasmapheresis in the treatment of collagen disease has been described by numerous investigators (6, 9).

The major treatment modalities for the collagen diseases were DFPP till 1987, then IPP with immunoadsorbent columns, consisting of phenylalamine conjugated polyvinyl alcohol (Immusorba PH350, Asahi medical Co. Ltd) (16).

Recently, various adsorbents are becoming available clinically. Immunoadsorbent IM-TR, consisting of tryptophan-linked polyvinyl alcohol gel (Asahi Medical Co. Ltd) (17), adsorbs a great deal of anti-AchR antibodies by hydrophobic interaction, so it is useful in the treatment of myasthenia gravis. Immunoadsorbent Biosynsorb is used for the removal of anti-red-cell antibodies, so it is useful in the major ABO-incomaptibility bone marrow and renal transplantations (4, 20).

Dextran sulfate cellulose bead columns (Kaneka) (18), which can bind selectively apoprotein B, almost the sole apoprotein of LDL, is now available for the removal of LDL-cholesterol in hypercholesterolemic patients.

Plasma exchange is effective in many intractable diseases. However, there are no clean-cut criteria for the use of plasmapheresis, and the clinical evaluation of plasmapheresis in the treatment of a number of diseases is not yet established, despite its effectiveness. Although therapeutically plasmapheresis is effective, many problems still remain concerning its indications, methods, optional schedules, and clinical effects.

REFERENCES
