Peritoneal dialysis

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ABSTRACT

Peritoneal dialysis is an important method of renal replacement therapy in cases of renal failure, which may be acute, categorized as prerenal, intrinsic or postrenal failure, and is usually reversible once the cause is rapidly identified and promptly corrected before kidney damage occurs.

Dialysis is the alternative in cases where no donor for the transplantation can be found, which may be hemodialysis or peritoneal dialysis which may be acute or chronic, and in cases of the latter a permanent peritoneal catheter is fixed under general anesthesia.

There are two main types for CPD, Continuous Ambulatory Peritoneal Dialysis and Continuous Cycler-Assisted Peritoneal Dialysis where a machine is used to fill the abdomen, not the patient himself. Both methods can sometimes be used in the same patient..

Key words : Peritoneal dialysis - Intraperitoneal -injection - Acute intermittent peritoneal dialysis (AIPD)

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List of Abbreviations

RI : Renal Insufficiency

ARF : Acute Renal Failure

CRF : Chronic Renal Failure

ESRD: End Stage Renal Disease

PD : Peritoneal Dialysis

HD : Hemodialysis

RRT : Renal Replacement Therapy

CRRT: Continuous Renal Replacement Therapy

IPD : Intermittent Peritoneal Dialysis

CAPD: Continuous Ambulatory Peritoneal Dialysis

CCPD: Continuous cycler-assisted Peritoneal Dialysis

APD : Automated Peritoneal Dialysis

NIPD : Nocturnal Intermittent Peritoneal Dialysis

RKF : Residual Kidney Function

nPNA: normalized Protein Nitrogen Appearance

SGA : Subjective Global Assesment

r-Hu EPO : Recombinant Human Erythropoeitin

HLA : Human Leukocyte Antigen

DRA : Dialysis Related Amyloidosis

PET : Peritoneal Equilibration Test

NIDDK : The National Institute of Diabetes and Digestive and Kidney Diseases

NKF : National Kidney Foundation

US RDS : The United Sates Renal Data System

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Introduction and Aim of Work

Intraperitoneal injection of saline solutions in dehydrated infants was described by Blackfan and Maxcy as early as 1918 (Blackfan and Maxcy, 1918); however, treating children with renal failure by peritoneal dialysis was first reported in the late 1940s (Bloxsum and Powell, 1948 ; Swan and Gordon, 1949). This group of investigators detailed the technique they followed by allowing large volumes of dialysate to flow continuously by gravity from 20-L carboys through a rigid metal catheter that has been surgically implanted into the upper abdomen. Drainage of the dialysate was achieved by water suction through another catheter implanted in the pelvis; a technique which is now known as "continuous peritoneal lavage" and which represents in a way, a continuous PD therapy.

The fluid balance in Swan & Gordon technique was maintained by adjusting the dialysate dextrose content between 2-4 gm/100mL; a concentration which is very much similar to that used in the PD solutions nowadays. Daily delivery of 23L of dialysate in Swan and Gordon technique was reported to achieve excellent solute removal. Nevertheless, this technique did not gain popularity among physicians dealing with renal failure, and it was more than 10 years before the use of PD was again reported.

In 1959, Maxwell, Rockney, and Kleeman, reported the use of PD as a practical short-term treatment for ARF using disposable nylon catheters and commercially prepared dialysis solutions (Maxwell et al., 1959).

Acute intermittent peritoneal dialysis (AIPD) as it is known now, was first reported by Segar, Gibson, and Rhamy in 1961, and by Etteldorf, Dobbins, and Sweeney in 1962 (Segar et al., 1961; Etteldorf et al., 1962).

The need for the insertion of the dialysis catheter in early IPD techniques for each treatment made it impossible for long term use especially in small patients (Maxwell et al., 1959).

In 1964, Palmer, Quinton, and Gray, introduced their "permanent" peritoneal catheter, which was perfected later in 1966 by Tenckoff and Schecter; then and only then, long-term IPD was possible for the pediatric ESRD patients (Palmer et al., 1964; Tenckoff & Schecter, 1966).

When Boen in 1964, and then Tenckoff in 1972, came up with their device of an automated dialysate delivery system that can be used at home, a new field of long-term PD therapy was opened. Not only it became practical, but even a desirable alternative to hemodialysis for children with ESRD (Boen et al., 1964; Tenckoff et al., 1972).

A breakthrough in the history of PD was the description of the continuous ambulatory peritoneal dialysis (CAPD) in 1976, which was then called "novel portable/wearable equilibrium dialysis technique" (Popovich et al., 1976). This technique, rapidly recognized for its advantages, became the favorite by the pediatric nephrologists in the management of ESRD in children.

Advantages of CAPD over hemodialysis in children are many, and include near- steady state biochemical control, no disequilibrium syndrome, greatly reduced dietary restriction and fluid limits, and freedom from repeated dialysis needle punctures. CAPD made possible for children with ESRD of all ages to have their dialysis at home with all its physical and psychological impacts of well-being. Moreover, CAPD

made possible the care of very young infants with ESRD, formerly considered to be too young to be amenable to treatment.

Oreopoulos et al., in 1978, were the first to use CAPD in a young child in Toronto; Balfe and Irwin published their first experience with CAPD in 1980, and since then CPD has become the dialysis modality commonly used all over many areas in the world for the treatment of ESRD in children (Alexander & Honda, 1993).

The aim of this work

Is to throw some light on the indications, types, advantages and disadvantages, and the possible complications of this modality of ESRD therapy. As well, the recommendations through further research in this respect towards a better understanding and mastering of this dialytic procedure.

Acute Renal Failure

Acute renal failure (ARF) represents a rapid decline in renal function sufficient to increase blood levels of nitrogenous wastes and impair fluid and electrolyte balance.

Unlike chronic renal failure (CRF), acute renal failure is potentially reversible if the precipitating factors can be corrected before kidney damage has occurred.

ARF is a common threat to seriously ill children in intensive care units, with a mortality rate ranging from 40%-75% (Singri et al., 2003).Although treatment methods such as dialysis and renal replacement methods are effective in correcting life-threatening fluid and electrolyte disorders, yet, the mortality rate from ARF has not changed substantially since the 1960s (Albright, 2001); this , probably, is because ARF is frequently superimposed on other serious situations such as trauma, shock, and sepsis.

The most common indicator of ARF is azotemia; an accumulation of nitrogenous wastes (urea nitrogen, uric acid, and creatinine) in the blood. In ARF, the GFR is decreased; consequently, excretion of nitrogenous wastes is decreased, and fluid and electrolyte balance cannot be maintained.

Types of Acute Renal Failure

ARF can be caused by a variety of conditions; these include a decrease in blood flow without ischemic injury to the renal tissue, ischemic, toxic, or obstructive tubular injury, and obstruction of urinary tract outflow.

The causes of ARF are categorized as *prerenal, intrinsic*, and *postrenal* (Brady et al., 2000; Nally, 2002; Abernethy and Lieberthal, 2003).

Table (1): Causes of Acute Renal Failure

Prerenal

- Hypovolemia Hemorrhage
- Dehydration
- Excessive loss of gastrointestinal tract fluids
- Excessive loss of fluid due to burn injury
- Decreased vascular filling
- Anaphylactic shock
- Septic shock
- Heart failure and cardiogenic shock
- Decreased renal perfusion due to vasoactive mediators, drugs, diagnostic agents

Intrinsic or intrarenal

- Acute tubular necrosis
- Prolonged renal ischemia
- Exposure to nephrotoxic drugs, heavy metals, and organic solvents Intratubular obstruction resulting from hemoglobinuria, myoglobinuria, myeloma light chains, or uric acid casts
- Acute renal disease (acute glomerulonephritis, pyelonephritis)

Postrenal

- Bilateral ureteral obstruction
- Bladder outlet obstruction