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VAN DIE REDAKSIE

KUNSMATIGE NIER

Die skeiding van opgeloste stowwe by wyse van differensiale diffusievermoë deur 'n poreuse vlies wat tussen twee oplossings geplaas is, staan bekend as dialise. Die vlies waardeur dialise kan plaasvind, mag van natuurlike of kunsmatige aard wees; as voorbeelde van eersgenoemde kan die maagdermkanaal of die buikvlies aangehaal word, en van laasgenoemde, die gebruik van sellofaan wat tussen die pasiënt se sirkulerende bloed en die dialiserende oplossing geplaas is.

Die maagdermkanaal is op verskeie verskillende maniere vir dialise gebruik, maar die metode van deursyfering van die dunderm deur 'n dubbelloop Miller-Abbot buis het veral byval gevind, aangesien dit help dat wisseling van opgeloste stowwe betreklik maklik beheer kan word. Die dialiserende oplossing moet sorgvuldig gekies word. Oplossings van natriumchloried mag tot edeem lei, en oplossings van sukrose of dekstrose tot oorhidrering of natrium- en kaliumuitputting. Die vloeistof wat voorkeur geniet het, was 'n 2%-oplossing van natriumsulfaat, wat deurgesyfer is teen 'n spoed en vir 'n tydperk om die individuele pasiënt te pas. Groot hoeveelhede ureum kan op hierdie wyse by uremiese pasiënte verwyder word met weinig gevaar dat ontsmetting hierdeur sal ontstaan. Die vernaamste tegniese moeilikheid mag die inlaat van die buis deur die maaguitgang wees by pasiënte wat aan mislikheid ly.

Die metode van buikvliesdialise is in sommige klinieke gebruik, maar die spesiale tegniese sorg wat dit vereis en die komplikasies wat mag ontstaan, soos byvoorbeeld proteïenverliese, oorhidrering en edeem en buikvliesontsteking, het veroorsaak dat vele werkers uitspoeling van die buikvlies laat vaar het ten gunste van deursyfering van die maagdermkanaal of buite-liggaamlike hemodialise by wyse van 'n kunsmatige nier.

Die eerste metode vir verwydering van stowwe uit die bloed by wyse van uitwendige dialise of vividiffusie, het bestaan uit 'n houër waarin 'n takstelsel van selloïdienbuis ingesluit was, wat as dialiserende vlies gedien het. Die verskillende tipes van dialiseerder wat vandag gebruik word, is wysigings van 5 basiese masjiene wat deur Kolff, Alwall, Murray *et al.*, Muirhead en Reid, en Skeggs en Leonard ontwerp is. In die Kolff apparaat word sellofaanbuis om 'n drom gedraai wat in 'n bad met dialiserende oplossing rondraai; hierdie tipe kunsmatige nier is baie gebruik. In hul besondere apparaat steun Alwall en Murray die sellofaanbuis in 'n taamlieke stywe posisie deur middel van draadskerms, wat

EDITORIAL

ARTIFICIAL KIDNEY

The separation of solutes by differential diffusibility through a porous membrane placed between two solutions is known as dialysis. The membrane through which dialysis can take place may be a natural one or artificial; of the former the gastro-intestinal tract or the peritoneum may be cited as examples, and of the latter the use of cellophane placed between the patient's circulating blood and the dialysing solution.

The gastro-intestinal tract has been used for dialysis in several different ways, but the method of perfusion of the small intestine through a double-lumen Miller-Abbott tube has been especially favoured since it enables exchanges of solutes to be relatively easily controlled. The dialysing solution has to be carefully chosen. Solutions of sodium chloride may lead to oedema, and sucrose or dextrose solutions to over-hydration or sodium and potassium depletion. The fluid of choice has been a 2% solution of sodium sulphate, perfused at a rate and for a period to suit the individual patient. Large amounts of urea may be removed in this way in uraemic subjects with little danger of introducing infection. The chief technical difficulty may be the introduction of the tube through the pylorus in patients suffering from nausea.

The method of peritoneal dialysis has been used in some clinics, but the special technical care required and the complications that may ensue, such as losses of protein, over-hydration and oedema, and peritonitis, have caused many to give up peritoneal lavage in favour of gastro-intestinal perfusion or extracorporeal haemodialysis by means of an artificial kidney.

The first method for removal of substances from the blood by means of external dialysis, or vividiffusion, consisted of a container enclosing a branched system of celloidin tubes which served as a dialysing membrane. The various types of dialyser in use today are modifications of 5 basic machines devised by Kolff, Alwall, Murray *et al.*, Muirhead and Reid, and Skeggs and Leonard. In the Kolff apparatus cellophane tubing is wound round a drum which revolves in a bath of dialysing solution; this type of artificial kidney has

ultrafiltrasie sowel as dialise moontlik maak. In die kunsmatige nier van Muirhead en Reid word daar van die prinsiep van adsorpsie op ruilingsharpuise gebruik gemaak, maar die metode is nog nie algemeen geëksploiteer nie. Skeggs en Leonard het die gebruik van sellofaanbuise laat vaar en sellofaanvelle tussen gegleufde rubberkussings gebruik; sodoende is 'n totaal onbuigbare apparaat ontwikkel, wat ultrafiltrasie sowel as dialise toelaat. Nogtans is hierdie masjien, net soos die ander wat genoem is, deur ander werkers gewysig. In onlangse tipes is die voordele van sellofaanbuise (Kolff) gekombineer met die steun wat totale onbuigbaarheid daaraan verleen (Skeggs-Leonard).

Hierdie 'kunsmatige nier'-masjiene is as navorsings-werktuie gebruik en ook vir die terapeutiese beheer van uitgesoekte gevalle van nierversaking. Hulle veroorloof eksperimentele manipulatie van die liggaams-vloeistowwe en die bestudering van stowwe in die bloed, asook die bestudering van die kwantitatiewe tussenverwantskappe van vloeistowwe en elektroliete, en het nog ander eksperimentele gebruike. Waar hierdie buiteliggaamlike dialiseerders by die behandeling van pasiënte gebruik word, vereis hulle 'n goed-opgeleide span werkers wat slegs beskikbaar is in groter mediese inrigtings waar geskikte geriewe te vind is. Die ontdekking wat tot dusver opgedoen is, dui aan dat die prosedure veilig is in die hande van ervare werkers. Die apparaat is nie alleen met sukses in burgerlike praktieke gebruik nie, maar ook in die Koreaanse Oorlog deur 'n span werkers van die VSA-leër.

Die kunsmatige nier is 'n waardevolle toevoegsel tot goeie behoudende mediese terapie by die beheer van die oliguriese fase van akute nierversaking en in die behandeling van vergiftiging deur sekere stowwe, soos byvoorbeeld salisilate en barbiturate, wat hulle tot diffusie leen. Die vernaamste aanduiding vir dialise is by akute nierversaking as gevolg van nierbuisnekrose, soos byvoorbeeld hemolitiese reaksie, niertoksiene en skok met anoksie. By chroniese nierversaking moet die aanduidings nog vasgestel word. Enige neiging tot bloeding by 'n pasiënt is 'n teenaanwysing vir die metode, aangesien heparin as stollingsteemiddel gebruik moet word om aftakking van die bloed toe te laat.

been very much used. Alwall and Murray support the cellophane tube in a semi-rigid position by wire screening in their particular apparatus, which is capable of ultrafiltration as well as dialysis. In the artificial kidney of Muirhead and Reid the principle of adsorption onto exchange resins is utilized, but the method has not yet been widely exploited. Skeggs and Leonard abandoned the use of cellophane tubing and used sheets of cellophane between grooved rubber pads; thus a completely rigid apparatus was developed which permits ultrafiltration as well as dialysis. However, this machine, like the others mentioned, has been modified by other workers. In recent types the advantages of cellophane tubing (Kolff) have been combined with complete rigidity of support (Skeggs-Leonard).

These 'artificial kidney' machines have been used as research tools and for the therapeutic management of selected cases of renal failure. They permit experimental manipulation of the body fluids and the study of substances in the blood and of the quantitative interrelationships of fluids and electrolytes, and have other experimental uses. For the treatment of patients the use of these extracorporeal dialysers requires a well-trained team that can only be available in larger medical institutions where facilities are adequate. The experience gained so far indicates that the procedure is safe in the hands of expert operators. The apparatus has been used with success not only in civilian practice but also in the Korean War by a US Army team.

The artificial kidney is a valuable adjunct to good conservative medical therapy in the management of the oliguric phase of acute renal failure and in the treatment of intoxication by certain diffusible substances such as salicylates and barbiturates. The chief indication for dialysis is in acute renal failure due to tubular necrosis, e.g. haemolytic reaction, nephrotoxins, and shock with anoxia. In chronic renal failure the indications remain to be established. Any bleeding tendency in a patient is a contra-indication to the method since heparin has to be used as anticoagulant to permit shunting of the blood.

Elkinton, J. R. en Danowski, T. S. (1955): *The Body Fluids*. Londen: Baillière, Tindall en Cox Bpk.
 Battezzati, M. en Taddei, C. (1956): *S. Afr. T. Geneesk.*, **30**, 100.
Symposium on the Artificial Kidney (1956): *Proc. Mayo Clin.*, **31**, 347-373.

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THERMOMETER INFECTION

Dr. I. Mirvish, of Cape Town, has conducted a campaign against the spread of infection amongst hospital patients through clinical thermometers. In 1953 he published a description¹ of a thermometer stand he had devised for use in hospital wards. The stand supports a row of Pyrex test-tubes, in each of which a labelled thermometer rests on cotton-wool in germicidal solution. The tubes are firmly gripped in clips and can readily be removed for boiling or changing of the antiseptic. The tubes are conspicuously labelled with consecutive numbers. For

each patient the bed or cot, the Pyrex tube, and the clinical thermometer, are labelled with the same number to prevent a patient's being given any but his own thermometer.

At the South African Medical Congress in 1955 Mirvish² returned to the charge and reported a bacteriological investigation of the thermometers in use in the wards of a certain general hospital. The thermometers were kept in an antiseptic solution (1 in 1,000 biniodide) supplied by the hospital dispensary and changed at

varying intervals, usually 2 or 3 times a week; and when tested they had usually been immersed in the solution for about 4 hours. More than a half of the thermometers, both oral and rectal, were found to be infected. In the former the commonest infections detected were viridans streptococci, diphtheroids and coagulase-negative *Micrococcus albus*; in the latter, enterococci and both coagulase-negative and coagulase-positive *M. albus*. Mirvish pointed out the obvious remedies, viz. that each patient should have his own thermometer and that when not in use it should be kept in an effective and suitable germicidal fluid. The thermometer stand was devised to admit of this in hospital wards, where it is generally inadvisable to keep the patient's thermometer at his bedside.

The *Lancet* in a recent editorial³ has discussed this subject and referred to Mirvish's work. The writer of the editorial mentions that in 1941 the Medical Research Council committee on cross-infection in hospitals⁴ recommended that each patient should have a separate thermometer, and says, 'Few nurses or doctors and still

fewer patients will disagree with this advice'. Yet only in a minority of hospitals is provision made for separate thermometers. Throughout Groote Schuur Hospital, Cape Town, Mirvish's apparatus is now in use and every patient has his own thermometer.

Frobisher *et al.*^{3,5} have found that 1 in 1,000 alcoholic solutions of quaternary ammonium compounds give complete sterilization after 10 minutes' immersion, and that this is more effective if the thermometers are wiped with soapy cotton-wool before being put in the fluid. Mirvish² finds two of these compounds, viz. cetrimide and benzalkonium chloride are non-irritating and non-toxic to raw surfaces.

1. Mirvish, I. (1953): *S. Afr. Med. J.*, **27**, 747.
2. *Idem* (1956): *Ibid.*, **30**, 413.
3. *Editorial* (1956): *Lancet*, **2**, 559.
4. *The Control of Cross-infection in Hospital* (1944): Med. Res. Coun. War Memo No. 11. London: H.M. Stationery Office. Revised edition 1951.
5. Frobisher, M., Sommermeyer, L. and Blackwell, M. J. (1953): *Appl. Microbiol.*, **1**, 187.