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Bulletin de la Dialyse à Domicile

Imaging and leaks in peritoneal dialysis

(Imagerie et brèches en dialyse péritonéale)

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Résumé

Les fuites de dialysat par brèche péritonéale sont des complications mécaniques non rares et redoutées en dialyse péritonéale (DP). Elles surviennent en général au début de la prise en charge par DP, et présentent diverses manifestations cliniques selon leur localisation. Le recours à des examens d'imagerie telles que la péritonéographie par scanner ou IRM, ou la scintigraphie péritonéale, permettent de confirmer le diagnostic, et d'établir un bilan lésionnel en cas d'indication chirurgicale. Ces explorations sont simples, non invasives, et accessibles en collaboration avec les radiologues et l'équipe de DP. Selon la localisation de la brèche, la DP peut être poursuivie à petits volumes ou doit être interrompue avec un transfert en hémodialyse, afin de permettre le rétablissement de l'étanchéité soit par cicatrisation soit par chirurgie. L'imagerie peut se révéler utile pour la vérification de la fermeture de la brèche et ainsi permettre la reprise de la DP. Les fuites précoces peuvent être évitées en respectant un délai de 14 jours entre la pose du cathéter et la première infusion. Le niveau de pression intra péritonéale ne semble pas être un facteur de risque significatif. Leur prévention repose principalement sur l'identification de facteurs de risque intrinsèques au patient tels que l'indice de masse corporelle, et les antécédents de chirurgie abdominale. Cet article a pour but de synthétiser les caractéristiques des brèches en DP, et les examens d'imagerie possibles pour limiter le transfert définitif en hémodialyse.

Mots clés : brèche, dialysat, dialyse péritonéale, péritonéographie, scanner

Summary

Dialysate leaks are non-rare mechanical but dreaded complications in peritoneal dialysis (PD). They usually occur at the beginning of PD, with various clinical events depending on their location. Use of imaging tests such as computed tomography (CT) peritoneography, or magnetic resonance imaging (MRI) peritoneography, or scintigraphic peritoneography, can confirm the diagnosis and guide surgical intervention if needed. These simple, non-invasive, and accessible tests can be done in collaboration between the radiological et peritoneal teams. Depending on the leakage site, PD can be pursued with small volumes with a cycler. In other cases, it must be interrupted and the patient transferred to hemodialysis, in order to permit the peritoneal cavity to regain its integrity by cicatrization or with surgical intervention. Imaging can help to make sure peritoneal cavity has regained its integrity after this period of transition. Early leaks can be avoided by delaying PD start with by 14 days. Intraperitoneal pressure does not seem to contribute significantly. Prevention of PD leaks essentially depends on individual risk factors such as obesity or anterior abdominal surgeries. This article reviews the characteristics of dialysate leaks in PD and the imagery tests to limit transfer to hemodialysis.

Key words : computed tomography, dialysate, peritoneal dialysis, peritoneography, leak

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DEFINITION ET INCIDENCE

Leakage of dialysate through peritoneal breach is a mechanical complication of peritoneal dialysis (PD) corresponding to a loss of seal in the peritoneal cavity [1]. It is a feared complication that can lead to temporary or permanent transfer to hemodialysis and infectious complications [2,3].

The dialysate leak can have several locations:
• Around the catheter (emergence or tunnel)
• Abdominal and genital wall +/- associated with a hernia
• Retroperitoneal
• Pleural

According to the French Language Peritoneal Dialysis Register (RDPLF), in 2020, 9% of transfers of PD to hemodialysis were related to a loss of ultrafiltration (UF), 3% to a pleuro-diaphragmatic breach, and 10% to the technique [4)]. It remains difficult to determine the exact proportion of peritoneal breaches within these transfers since the breaches may correspond to several reasons for transfer to hemodialysis. The incidence of this mechanical complication is variable, and the definition of PD failure is not consistent across registry studies. In addition, several studies have been restricted to a single type of breach, such as the pleuro-diaphragmatic breach. Although it is estimated that these breaches concern more than 5% of patients treated by continuous ambulatory peritoneal dialysis [5], the lack of consensus on the definition and the heterogeneity of the criteria for stopping the technique do not allow us to establish the exact incidence of dialysate leaks today [6].

CLINICAL PRESENTATION

Temporality: mechanical complications of the breach type generally occur during the first weeks of PD treatment. We can thus distinguish early breaches (<30 days), which are mainly located around the catheter, and later breaches (> 30 days), which are more often linked to fragility of the abdominal wall.

The loss of tightness can manifest itself at the level of the path of the catheter or next to a hernia (parietal breach), at the level of the genitals (hydrocele) via the persistence of a peritoneo-vaginal canal, or at the pleural level with hydrothorax [1].

There are several clinical manifestations depending on the site concerned. They can be diagnosed during a loss of ultrafiltration (UF), during weight gain, or clinically during the appearance of an abdominal arch, subcutaneous edema, increased blood pressure volume of the genitals, or the appearance of unilateral pleural effusion [2,7].

Parietal breaches are generally the earliest, and appear during the 14 days following the insertion of the catheter or during the first exchanges, either at the level of the exit orifice of the catheter, along the path of the catheter, or at the level of the catheter in the surgeon's intervention sites during catheter placement. They are not hernias because they correspond well to a dialysate leak, but they can be associated with pre-existing or de novo hernias [8]. A wall breach may manifest as a discharge emerging from the PD catheter. Testing for glucose with a urine dipstick applied to this fluid can quickly confirm the diagnosis.

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The breach can be manifested by the occurrence of an abdominal arch, which may be painless. Clinical examination of the abdomen for asymmetry may support the diagnosis.

Hydrocele corresponds to a fluid collection next to the testes or loss of tightness in the peritoneo-vaginal canal. It can be unified or bilateral. In the event of swelling of the bursae, transillumination (a light source behind the scrotum) makes it possible to distinguish the liquid or solid nature of it, and thus confirm the diagnosis of hydrocele.

A retroperitoneal breach is manifested primarily by an acute loss of ultrafiltration without further clinical manifestation [9].

Hydrothorax is the loss of the pleuroperitoneal seal, and manifests as cough or dyspnea. It can be asymptomatic. It occurs more often on the right than on the left due to the juxtaposition of the heart on the left. It can occur from the first exchange of PD. Lung auscultation confirms the diagnosis, and is an important part of the clinical examination of the patient treated with PD [10].

IMAGERY

In case of diagnostic doubt, an imaging examination may be indicated. Imaging can also help with resumption of PD to check for restoration of the seal in the peritoneal cavity. [10].

Peritoneography by CT scan is the gold standard for its simplicity and accessibility. It consists of injecting 100 mL of iodinated contrast product dosed at 300 mg / mL (PCI) in the volume of dialysate usually infused in the patient (2 liters of dialysate, for example) more than 30 minutes before the examination. It is recommended that the patient be asked to mobilize before the examination, if possible, to better distribute the ICH and allow dissemination within the breach if it exists. The dialysate can be drained at the end of the scan.

Apart from an allergy to PCI and its irradiating nature, there are no contraindications to this non-invasive and easily accessible procedure on a routine basis.

This examination confirms the diagnosis and makes it possible to establish an accurate lesion assessment in the event of an associated hernia, with a view to surgery. During a hydrocele, it makes it possible to distinguish a breach by peritoneo-vaginal rupture from the fragility of the anterior abdominal wall [3,11] (Figure 1).

Peritoneography can also be performed by MRI with injection of Gadolinium salt into the peritoneal cavity. It represents an alternative in case of allergy to iodinated contrast agent. It sometimes, but rarely, exposes the patient to the risk of systemic nephrogenic fibrosis. The lead times, the classic MRI contraindications, and the cost of the examination do not make it the first-line examination in this indication.

The procedure consists of injecting 20mL of Gadolinium in the volume of dialysate usually infused in the patient (2 liters of dialysate, for example), 30 minutes before the MRI, and recommending that the patient mobilize if possible before the examination.

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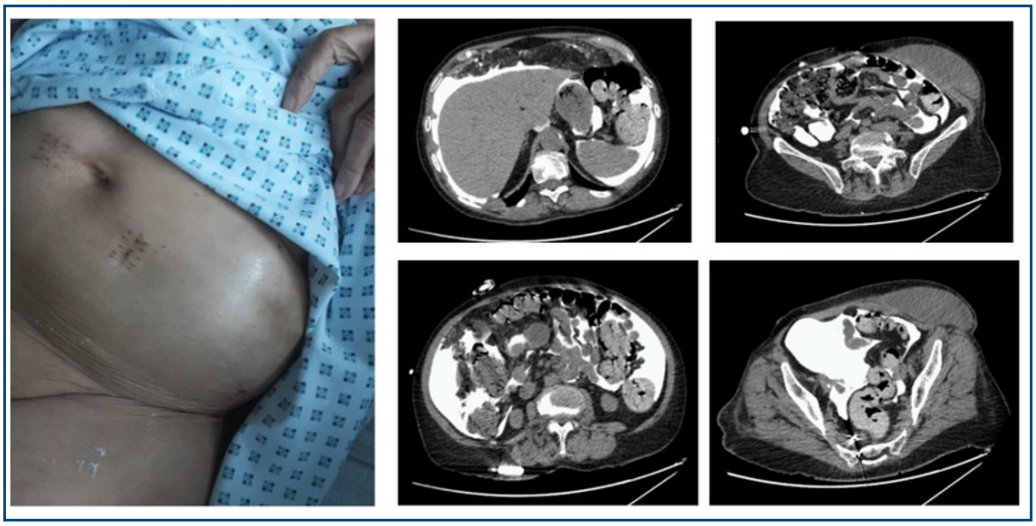

Figure 1. Abdominal arching after catheter removal/re-implantation suggestive of a parietal breach, and CT scan images showing the tightness of the peritonea cavity after 14 days without PD

Peritoneal scintigraphy with isotope injection into the peritoneal cavity is less often indicated. It consists of injecting an isotopic tracer (Technecium 99m) into the dialysate which is infused into the peritoneum before being drained after several acquisitions. Acquisitions are made every 5 minutes for 1 hour [12]. In addition to parietal breaches, it is mainly used to diagnose hydrothorax, which is otherwise identifiable by chest x-ray and pleural puncture with analysis of the fluid, which is transudative [13].

THERAPEUTIC CARE

The identification of a breach usually requires the interruption of PD with temporary transfer to hemodialysis due to mechanical complications, loss of UF, or the risk of infection [7].

There is no consensual recommendation on the precise course of action, even if the principle is to limit the leak, either by stopping the PD or by transferring to APD at small volumes.

In the event of an early breach, most authors recommend a 14-day stop to allow healing of the peritoneal cavity before attempting to resume the previous program [14,15]. In the event of an associated hernia [8], or hydrocele [16], PD can only be resumed after surgical management.

In the event of a breach in the wall or around the catheter, antibiotic prophylaxis is recommended to limit the risk of infections such as tunnelitis [17].

In hydrothorax, PD is usually stopped from the outset with either a definitive transfer to hemodialysis or the use of specialized surgical treatment with pleural talcage [10].

A check of the tightness of the peritoneal cavity after a period of respite can be performed by peritoneography by CT scan or MRI (Figure 2).

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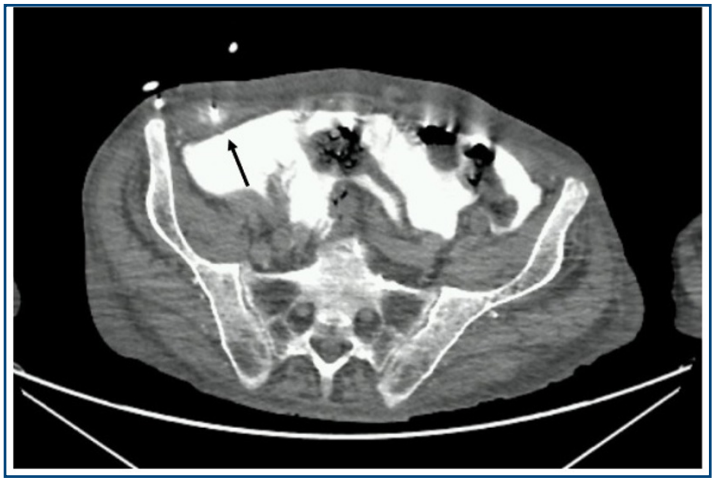

Figure 2. Peritoneography image by CT scan to check the tightness of the peritoneal cavity after an episode of early peri-catheter breach (arrow)necessitating a temporary transfer to hemodialysis

RISK FACTORS AND PREVENTION

We can differentiate two categories of risk factors: those related to the technique itself, and those related to the intrinsic criteria of the patient.

The factors inherent in the technique correspond to those which favor the leakage of dialysate by increasing the intra-abdominal pressure. First of all, it is not recommended to start PD during the 14 days following catheter placement. This safety period allows good healing and sealing of the peritoneal cavity facing the path of the catheter and facing the operating sites. It may happen that the use of the RFP cannot be deferred. It is then advisable to use a program with low infusion volumes, and if possible with a cycler in supine, to avoid leaks [18].

Despite a safety period of 14 days, it can happen that a peritoneal breach can occur, mainly around the catheter. This leakage can be favored by a too-high infusion volume. The surgical technique of catheter placement seems to have a significant impact on the risk of breaches and hernias [19]: the paramedian approach during catheter placement is preferred over the midline approach [8].

The infusion of dialysate into the peritoneal cavity automatically causes an increase in intra-abdominal pressure (PIP), which, if excessive, will in theory promote a breach.

The relationship between infusion volume and PIP is linear. Since intra-abdominal hyperpressure may be asymptomatic, its measurement is therefore strongly recommended routinely at the initiation of PD, or in the event of a change in the volume of dialysate infusion.

The principle consists in measuring the height of the column of dialysate at atmospheric pressure in the drainage line, before the drainage of the volume of intraperitoneal dialysate [20]. The zero level is defined by the midaxillary line. The pressure increases during inspiration and decreases during expiration. It is the average of these two measurements that is used. A PIP limit of 13 cm of water is commonly adopted, while a PIP greater than or equal to 20 cm of water is considered pathological.

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Despite an intuitively obvious correlation, the cause-and-effect relationship between PIP and mechanical complication in PD is not clearly demonstrated in the literature [21–24]. However, the conditions for measuring the PIP in consultation do not systematically reflect the actual daily PIP. PIP can indeed be favored by the position of the patient, his physical activity, or even in the event of a cough. PIP therefore seems to be a risk factor for peritoneal breach, but the patient's intrinsic factors seem more decisive.

The patient's intrinsic risk factors therefore seem to be the most likely to cause a dialysate leak. These include history of abdominal surgery, BMI, and polycystic kidney disease. Age, sex, and the presence of type 2 diabetes with metabolic syndrome are not significantly associated with a risk of peritoneal breach.

CONCLUSION

Leaking dialysate is a not uncommon complication in PD. It usually occurs at the start of treatment, but can correspond to several clinical situations, making the diagnosis sometimes difficult. Imaging, and in particular CT scan peritoneography, which is a simple and accessible examination to confirm the diagnosis and help make therapeutic decisions, plays an essential role in these cases. It can also confirm the good seal of the peritoneal cavity after a period of withdrawal or even temporary transfer to hemodialysis.

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Disclosure

The authors declare no conflict of interest for this article.

Contribution of authors

Vincent Leduc and Emilie Poidevin reviewed the article and suggested corrections

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