

STROBE Statement—Checklist of items that should be included in reports of cohort studies

“Predictors and Clinical Utility for Positive Abdominal Imaging Findings in Patients Presenting with Peritoneal Dialysis Associated Peritonitis: A Large Regional Health Service Perspective”

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found Title: “Predictors and Clinical Utility for Positive Abdominal Imaging Findings in Patients Presenting with Peritoneal Dialysis Associated Peritonitis: A Large Regional Health Service Perspective” Abstract <i>Introduction:</i> Peritoneal dialysis (PD) associated peritonitis is a common yet serious complication for those undergoing PD. The role of imaging patients presenting with suspected PD peritonitis is unknown. In addition to healthcare costs and patient exposure to ionising radiation, residual kidney function may be at risk with repeated contrast administration. The aim of this study is to understand the indications and ultimate clinical utility of abdominal imaging in patients presenting with PD peritonitis to a large regional health service <i>Methods:</i> Retrospective cohort analysis of patients admitted with PD peritonitis to Bendigo Health was conducted. Use and modality of abdominal imaging was recorded. Findings were categorised as positive when congruent with the patient’s presenting abdominal pain, or incidental when unrelated. Where imaging was performed, overall influence on patient care was assessed. <i>Results:</i> There were 53 episodes occurring across 31 patients admitted with PD peritonitis between December 2016 to February 2024. Abdominal imaging was performed in 81% of these episodes (n=43). Positive imaging findings occurred in 31% (n=16), with constipation being frequently identified. Incidental findings occurred in 28% (n=14), while 41% (n=21) showed no abnormalities. No patient or episodic factors were significantly associated with positive imaging findings. Of patients imaged, clinical management was influenced in 21% (n=9) of cases. <i>Conclusion:</i> Abdominal imaging in suspected PD peritonitis demonstrates low clinical utility, with positive findings directly influencing management in only a minority of cases. There is insufficient evidence to routinely recommend imaging for this cohort.
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported As addressed in ‘Introduction’: Peritoneal dialysis associated peritonitis (PD peritonitis) is a common yet serious infectious complication that occurs in patients undergoing peritoneal dialysis. Diagnosis is initially made based on a history of abdominal pain and cloudy PD effluent, along with constitutional symptoms such as fever and lethargy. Whilst PD fluid samples take time to culture, empiric treatment is often initiated in the form of indwelling intra-peritoneal antibiotics. The role for abdominal imaging including computer tomography (CT) and ultrasound (US) in aiding the diagnosis and ruling out other abdominal pathology in PD patients presenting with abdominal pain remains unknown. There is potential for harm with excessive imaging, such as radiation exposure, healthcare related costs and potentially a risk of deteriorating any residual renal function if intravenous contrast agent is utilized.
Objectives	3	State specific objectives, including any prespecified hypotheses As addressed in ‘Introduction’: The aim of this study is to understand the perceived indications and ultimate clinical utility of abdominal imaging in patients presenting with PD peritonitis. This study aims to identify predictive patient and episodic factors for positive abdominal pathology that may be used to guide the decision to pursue abdominal imaging. The secondary aim of this study is to also evaluate the influence positive imaging findings have on patient care. In doing so, this study will hopefully help direct investigations and limit unnecessary and potentially harmful tests.
Methods		

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Study design	4	Present key elements of study design early in the paper As addressed in 'Materials and Methods': Retrospective cohort analysis evaluated all presentations of confirmed PD peritonitis requiring in-patient hospitalisation at Bendigo Health between December 2016 to February 2024. Episodes of confirmed PD peritonitis presenting to the emergency department were identified by review of audit data collected by the Bendigo Home Therapies Department. Out-patient managed PD peritonitis episodes were excluded from analysis, including those that presented to the emergency department but were subsequently discharged on the same day without in-patient admission (one episode). Manual screening of individual patient electronic records, pathology, and radiology reports ensued.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection As addressed in 'Materials and Methods': Episodes of confirmed PD peritonitis presenting to the emergency department were identified by review of audit data collected by the Bendigo Home Therapies Department. Data was audited from between December 2016 to February 2024. Out-patient managed PD peritonitis episodes were excluded from analysis, including those that presented to the emergency department but were subsequently discharged without in-patient admission. As this was a retrospective analysis, no follow up was required. All data was manually screened for on electronic medical records.
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up As addressed in 'Materials and Methods': Episodes of confirmed PD peritonitis presenting to the emergency department were identified by review of audit data collected by the Bendigo Home Therapies Department across the pre-defined study period. If in-patient admission was required, patient episodes were included in analysis. Out-patient managed PD peritonitis episodes were excluded from analysis, including those that presented to the emergency department but were subsequently discharged without in-patient admission. PD peritonitis was defined in this dataset by ISPD criteria wherein there was at least 2 of: clinically compatible features of PD peritonitis (cloudy dialysis effluent, abdominal pain); elevated dialysis effluent leukocyte count >100 cells/ μL (with a polymorphonuclear predominance of at least 50%); or positive dialysis effluent microcultures. As this was a retrospective cohort analysis, no follow up was required. (b) For matched studies, give matching criteria and number of exposed and unexposed Not applicable to this study.
Variables	7	<i>Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable</i> As addressed in 'Materials and Methods': Variables assessed in this study can be split into patient baseline factors and patient episode factors as follows: Baseline patient characteristics collected included gender, age at presentation, modality of PD (APD vs CAPD), underlying cause for end-stage renal failure (ESRF), and medical comorbidities including previous abdominal surgery. The total number of peritonitis episodes per patient within the study timeframe was also assessed. Refractory (persistent infection despite five days of appropriate antibiotic therapy) or relapsing Episode factors: length of admission, septic status on presentation, requirement for ICU admission and ICU length of stay. The causative organisms (gram positive, gram negative, culture negative, polymicrobial, or fungal) and peak PD fluid cell counts were also recorded. Furthermore, the necessity for PD catheter removal and transition to HD (interim or permanent) was also noted. Outcomes were positive, negative, or incidental imaging findings: Imaging was classified as having 'positive findings' when the results were congruent to the patient's presentation of abdominal pain (including acute surgical pathologies and constipation). Negative findings were defined as no abnormalities seen on scan. Incidental findings were defined as abnormalities present that could not explain or be linked to the presentation of PD peritonitis (e.g. adrenal incidentalomas, subacute biliary pathology).

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Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Data was extracted retrospectively from patients' electronic medical records, including admission notes, pathology results, microbiology reports, and intensive care unit records. Baseline variables collected included age at presentation, sex, peritoneal dialysis modality (automated peritoneal dialysis [APD] or continuous ambulatory peritoneal dialysis [CAPD]), underlying cause of end-stage renal failure (ESRF), previous abdominal surgery, and other documented medical comorbidities. The total number of peritonitis episodes per patient during the study period was recorded. Peritonitis episodes were classified as de novo, refractory, or relapsing according to standard definitions defined by ISPD. Refractory peritonitis was defined as persistent infection despite five days of appropriate antibiotic therapy, while relapsing peritonitis was defined as recurrence with the same organism within four weeks of completing treatment for a previous episode. Clinical outcomes collected for each episode included hospital length of stay, presence of sepsis at presentation, intensive care unit (ICU) admission, ICU length of stay, causative organism (Gram-positive, Gram-negative, culture-negative, polymicrobial, or fungal), peak peritoneal dialysis fluid white cell count, requirement for peritoneal dialysis catheter removal, and transition to haemodialysis (temporary or permanent). Sepsis was defined according to the Australian Commission on Safety and Quality in Health Care criteria, based on the presence of vital sign abnormalities, clinical or biochemical evidence of hypoperfusion, or altered mental status.
Bias	9	Describe any efforts to address potential sources of bias As manual review of each patient episode was required for collection of data points, no blinding was achievable in this study. After initial data collection, patient UR numbers were de-identified by production of study numbers, prior to data analysis ensued. Data was extracted retrospectively from electronic medical records using predefined variables and standardised data collection procedures to minimise information bias. Standardised definitions were applied for refractory and relapsing peritonitis, as well as sepsis, in accordance with established clinical guidelines, to reduce misclassification. Outcomes and baseline characteristics were obtained from routinely recorded clinical documentation, laboratory results, and microbiology reports, thereby limiting subjective assessment
Study size	10	Explain how the study size was arrived at Study size was determined by access to electronic patient records available over the defined study timeline. Unfortunately, preceding December 2016 Bendigo Health utilised written medical records that would have been too cumbersome to manually explore in depth for this style of analysis. We do believe this study does cover a broad time frame however (over 7 years) and offers insight into a large regional hub's exposure to peritoneal dialysis medicine.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Continuous variables, including age, hospital length of stay, intensive care unit length of stay, and peak peritoneal dialysis fluid white cell count, were analysed as continuous measures. Categorical variables included sex, peritoneal dialysis modality, underlying cause of end-stage renal failure, previous abdominal surgery, causative organism, sepsis at presentation, intensive care unit admission, peritoneal dialysis catheter removal, transition to haemodialysis, and peritonitis classification (de novo, refractory, or relapsing). The number of peritonitis episodes per patient within the study period was made categorical (1 episode, 2 episodes, 3 episodes, etc.) for analysis.
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Categorical variables were summarised using counts (n) and percentages, and continuous variables were described using mean $\pm$ standard deviation or median with interquartile range, as appropriate. Associations between patient factors, clinical features, and positive imaging outcomes were initially assessed using Fisher's exact test for categorical variables, or a Student's <i>t</i> test for continuous variables. Variables showing a significant association on univariable screening were subsequently entered into univariable binary logistic regression models to derive odds ratios (OR) and corresponding 95% confidence intervals (CI) quantifying the strength of association. For one variable (past history of diabetic nephropathy), a zero-cell count in the 2x2 contingency table precluded standard logistic regression due to complete separation; Firth's penalized logistic regression was therefore used instead, with significance assessed via the penalized likelihood ratio test. Statistical significance was defined as a two-tailed p-value <0.05. (b) Describe any methods used to examine subgroups and interactions No subgroup analysis was applicable or performed in this data set.

		Item No	Recommendation
			(c) Explain how missing data were addressed No missing data was encountered in this retrospective cohort analysis. Further episodes preceding December 2016 were wholly excluded from review as they reflected pre-implementation of an electronic medical record and would have made data analysis too cumbersome/unpractical.
			(d) If applicable, explain how loss to follow-up was addressed Not applicable in this retrospective cohort analysis.
			(e) Describe any sensitivity analyses No sensitivity analysis was performed for this dataset.
Results			
Participants	13	a)	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed A total of 54 patient episodes occurred across 31 patients between December 2016 to February 2024. One patient episode was excluded from review as they presented to the emergency department but were subsequently managed as an out-patient without the need for admission. 53 patient episodes were included and subsequently analysed in this study. As this was a retrospective cohort study, no follow-up was required.
		(b)	Give reasons for non-participation at each stage Not applicable – this was a retrospective cohort analysis, and consent to participate was waived by the relevant ethics body as this was deemed a low/negligible risk study.
		(c)	Consider use of a flow diagram As nearly all patient episodes were included for analysis (53/54) we did not deem addition of a flow diagram beneficial for this cohort analysis.
Descriptive data	14*	(a)	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Bendigo is a large regional city in country Victoria, Australia. Bendigo Health Nephrology care includes in-hospital intermittent haemodialysis and at home peritoneal dialysis. We do not currently facilitate overnight home-haemodialysis. With our expanding population we have a large contingent of home peritoneal dialysis users. As with many patients' requiring dialysis, lower socioeconomic status is over-represented in our patient cohort. As this was a retrospective analysis we do not believe any patient cofounders were applicable to our dataset, but rather represent real-life presentations of this patient group.
		(b)	Indicate number of participants with missing data for each variable of interest No missing data was identified in any of the patient records manually assessed.
		(c)	Summarise follow-up time (eg, average and total amount) No follow up of participants was required for this retrospective cohort analysis.
Outcome data	15		Report numbers of outcome events or summary measures over time As addressed in Results: Past history of ischaemic heart disease appeared predictive for positive findings (OR 4.80, 95CI 1.16 to 19.93, P = 0.04), whilst a history of hypertension appeared protective (OR 0.21, 95CI 0.05 to 0.87, P = 0.04), although confidence intervals were broad. Diabetic nephropathy also appeared protective, with Firth's penalized logistic regression corroborating the Fisher's exact test finding (OR = 0.09, P = 0.02 by penalized likelihood ratio test), although the 95% confidence interval was broad (0.004–1.94) reflecting the small sample size. No other patient factors were significantly associated with an increased likelihood of positive imaging findings (see Table 2). No episodic features were more likely to result in positive imaging findings. Of patients that had imaging performed, clinical management was determined to be influenced in 21% (n=9) of cases. Review by the general surgical team was sought in 7/9 cases, antibiotics directed to diverticulitis in 1/9 cases, and aperients were administered in 1/9 cases where they had previously not been empirically prescribed. Of the surgical reviews 4/7 were determined not to have any acute surgical pathology clinically and thus did not require an operative or change to their current management. Two patients were taken for operations (drainage of abdominal collections, cholecystectomy), and one patient was managed for cholecystitis conservatively given their frailty and non-suitability for an operation.

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Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included This is not applicable to this retrospective cohort analysis. (b) Report category boundaries when continuous variables were categorized Continuous variables such as age were not categorised into age bracket groups, rather they were left continuous assuming normal distribution. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Unfortunately due to the limited sample size we cannot make any determinations of absolute risk over time in this cohort analysis.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses. This is not applicable to this retrospective cohort analysis.
Discussion		
Key results	18	Summarise key results with reference to study objectives This study aimed to determine the predictors and ultimate clinical utility in abdominal imaging for patients admitted with peritoneal dialysis associated peritonitis. No baseline patient factors - including age, comorbidities, cause of ESRF, PD modality, or previous abdominal surgery - were significantly associated with positive findings. Similarly, no episode related factors such as length of stay, PD culture organism and cell count, need for ICU, or transition to HD correlated with positive findings The influence of imaging on patient management was limited, altering care in approximately one in five cases. Surgical review was the most common outcome, though in more than half of these cases no intervention was required. Antibiotics were directed to diverticulitis in one case, and aperients prescribed in another where they had not been empirically initiated. While these represent clinically meaningful changes, the overall proportion highlights that imaging often did not materially alter management, consistent with the uncertainty around its role as detailed in current ISPD guidelines. Our findings build upon existing literature by demonstrating that abdominal imaging is frequently performed in PD-associated peritonitis but often identifies incidental findings or diagnoses that may not require imaging to confirm, such as constipation. Furthermore, it appears that the overall yield once positive findings are found remains low, as management is often unchanged. This further supports a more selective, indication-driven approach, balancing diagnostic yield with the risks of radiation, contrast exposure, and healthcare costs.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias The main limitation of this study is its modest sample size, which reduces power to detect significant associations that may limit generalisability. What this study does add is the perspective of perceived indications for imaging in this cohort (often to 'rule out' pathology / negative predictive value), and the ultimate utility in doing so. Further multicentre work is required to guide evidence-based imaging recommendations in suspected PD peritonitis. As this study relied on manual screening of electronic patient records, procedural and analysis bias may be at risk. This was mitigated by assigning study numbers instead of patient identifying URNs after initial data collection, with our data set then being analysed. The retrospective nature of this study also precludes any selection bias, as further evidenced by nearly all patient episodes included in this study.

	Item No	Recommendation
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Abdominal imaging in patients with PD peritonitis demonstrated relatively low clinical utility, with positive findings directly influencing management in only a minority of cases. The frequent identification of incidental findings and diagnoses such as constipation - often clinically suspected without imaging - suggests that scans may contribute more to healthcare costs and patient risk than to meaningful changes in care. This study remains uncertain as to whether any patient factors, presenting features, or pre-test characteristics are predictive for positive imaging findings. Larger, multicentre studies are required to determine whether such predictive factors exist and to better define which patients may benefit from abdominal imaging, thereby guiding more judicious and cost-effective use. In PD peritonitis, abdominal imaging should be reserved for cases with clear clinical indication, as routine use offers limited benefit while exposing patients to unnecessary risks and healthcare costs.
Generalisability	21	Discuss the generalisability (external validity) of the study results The generalisability of this study is in part limited by the small size of this analysis. It does however offer a perspective on the perceived need for abdominal imaging, the utility in pursuing this and does raise questions about the potential for harm that may arise as a consequence of excess imaging. This study also offers a unique rural perspective and does cover a considerable time frame (>7 years) giving insight for other similar or smaller sized health services that cater for patients undergoing PD.
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based The authors declare that there are no financial, personal, or professional conflicts of interest to report regarding the research, authorship, and/or publication of this manuscript. No funding was supplied for the purpose of this study

**Give information separately for exposed and unexposed groups.*

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.