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Systematic Review and Meta-analysis of Diagnostic Accuracy of Percutaneous Renal Tumour Biopsy

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Abstract

Context: The role of percutaneous renal tumour biopsy (RTB) remains controversial due to uncertainties regarding its diagnostic accuracy and safety.
Objective: We performed a systematic review and meta-analysis to determine the safety and accuracy of percutaneous RTB for the diagnosis of malignancy, histologic tumour subtype, and grade.
Evidence acquisition: Medline, Embase, and Cochrane Library were searched for studies providing data on diagnostic accuracy and complications of percutaneous core biopsy (CB) or fine-needle aspiration (FNA) of renal tumours. A meta-analysis was performed to obtain pooled estimates of sensitivity and specificity for diagnosis of malignancy. The Cohen kappa coefficient (κ) was estimated for the analysis of histotype/grade concordance between diagnosis on RTB and surgical specimen. Risk of bias assessment was performed (QUADAS-2).
Evidence synthesis: A total of 57 studies recruiting 5228 patients were included. The overall median diagnostic rate of RTB was 92%. The sensitivity and specificity of diagnostic CBs and FNAs were 99.1% and 99.7%, and 93.2% and 89.8%, respectively. A good ($\kappa = 0.683$) and a fair ($\kappa = 0.34$) agreement were observed between histologic subtype and Fuhrman grade on RTB and surgical specimen, respectively. A very low rate of Clavien $\geq$2 complications was reported. Study limitations included selection and differential-verification bias.
Conclusions: RTB is safe and has a high diagnostic yield in experienced centres. Both CB and FNA have good accuracy for the diagnosis of malignancy and histologic subtype, with better performance for CB. The accuracy for Fuhrman grade is fair. Overall, the

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quality of the evidence was moderate. Prospective cohort studies recruiting consecutive patients and using homogeneous reference standards are required.

Patient summary: We systematically reviewed the literature to assess the safety and diagnostic performance of renal tumour biopsy (RTB). The results suggest that RTB has good accuracy in diagnosing renal cancer and its subtypes, and it appears to be safe. However, the quality of evidence was moderate, and better quality studies are required to provide a more definitive answer.

1. Introduction

The management of renal tumours has evolved, with the increasing use of nonextirpative therapies for small renal masses (SRMs) in selected patients and the advent of effective targeted drugs for metastatic disease [1]. This has led to an increasing recognition of the importance of histologic characterisation of renal masses before treatment to tailor therapy based on tumour histology either in the localised or metastatic setting [2].

Percutaneous renal tumour biopsy (RTB) has been criticised due to concerns regarding its safety, diagnostic accuracy, and ability to distinguish tumour histologic subtypes and nuclear grade. Although fine-needle aspiration (FNA) and core biopsy (CB) have been used to sample renal tumours, the best technique has not been clearly defined [3]. Several recent studies have reported low complication rates and good diagnostic performance of RTB, but most studies were limited by small sample sizes, heterogeneous populations, different biopsy techniques, and lack of standardised definitions for diagnostic accuracy [4].

We performed a systematic review of the literature and meta-analysis to determine the diagnostic performance and safety of RTB in characterising malignancy, histologic subtype, and grade of renal tumours.

2. Evidence acquisition

2.1. Search strategy

The review was performed according to Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) [5] and the Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy [6]. Studies on percutaneous RTB (January 1, 1946, to September 1, 2014) were identified by highly sensitive searches of electronic databases (Medline, Medline In-Process, Embase, Cochrane Controlled Trials Register, and LILACS) and relevant Web sites [7]. The search was complemented by the reference lists of included studies and additional reports identified by the European Association of Urology (EAU) Renal Cell Carcinoma (RCC) Guideline Panel. No language restrictions were imposed. Two reviewers (L.M. and S.D.) screened all abstracts and full-text articles independently. Disagreement was resolved by a third party (T.L.).

2.2. Selection of studies

Prospective or retrospective cohort studies providing data on accuracy for malignancy, tumour histotype and grade, and/or on complications of percutaneous CB or FNA of solid or cystic renal masses of any size in adult patients were included. Studies that fulfilled the following criteria were included for the evaluation of diagnostic accuracy for malignancy: (1) reference standard for tumour malignancy represented by pathology on surgical specimen of partial or radical nephrectomy performed after RTB, or clinical and radiologic follow-up of at least 12 mo showing presence or absence of tumour progression and/or onset of tumour-related symptoms; (2) availability of number of nondiagnostic biopsies; and (3) availability of number of diagnostic biopsies classified as true positives (TPs), false positives (FPs), false negatives (FNs), and true negatives (TNs) either as group totals or by case-by-case enumeration of diagnoses. Studies that did not provide data on all four elements of diagnostic accuracy were excluded.

Studies that provided data to assess concordance between tumour grade and/or histologic subtype between RTB and surgical pathology were included for the assessment of diagnostic accuracy for histologic subtype and/or grade.

Studies exclusively reporting complications of RTBs were also included. Complications were graded according to the Clavien-Dindo classification [8]. Studies on laparoscopic-assisted or ex vivo RTBs were excluded.

2.3. Data extraction

A data extraction form was developed a priori to collect information on study design, patient characteristics (age, gender, indication for RTB, comorbidities), tumour features (size, solid or cystic pattern), RTB characteristics (needle size, image guidance, number of cores, biopsy technique), reference standard (surgery performed, follow-up length and protocol), and outcome measures (accuracy and complications).

2.4. Quality assessment

Risk of bias (QUADAS-2 tool [9]) was assessed for studies included in the diagnostic accuracy meta-analysis and in the analysis of accuracy for tumour histotype and grade.

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