

Renal Biopsy: A Nursing Perspective

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Abstract

Nurses are the major carers for patients who undergo a renal biopsy. This article discusses the history of renal biopsy, indications and contraindications, complications, nursing management, current procedure and summarised biopsy results. It is essential for nursing staff to understand the rationale behind renal biopsy to ensure optimal care and safety is provided to patients undergoing this procedure. Nurses need to identify early indications to prevent adverse complications of renal biopsy.

Introduction

Renal biopsy refers to the removal of living tissue from the kidney to examine changes under a microscope (Terrill, 2002). A biopsy provides greater information than urinalysis and serum creatinine alone (Cross & Jayne, 2005). Ultrasound-guided closed or percutaneous renal biopsy is most commonly practised (Tomson & Plant, 1997) and will be the focus of this article. This article aims to address the history and purpose of renal biopsy, indications and contraindications, complications, nursing management, current procedure and summarised biopsy results in order for nursing staff to understand the rationale behind renal biopsy and to contribute to optimal patient care and safety.

History

Early evidence of renal biopsy comes from those performed in post mortem in the early 1900s. Open biopsy was practiced to remove cysts or tumours but not for diagnosis of other renal diseases (Pirani, 1996). The first percutaneous needle biopsy of the kidney was in 1934

which was performed on palpable renal tumours. The first needle biopsies for the diagnosis of medical diseases of the kidney was in Denmark in 1951 (Iverson & Brun cited in Nelson, Mackinnon & Charlesworth, 2001). There was no ultrasound or computed tomography (CT) available so a blind technique was used using the entry site of the lower pole of the kidney, midway between the twelfth rib and the iliac crest (Matassarín-Jacobs, 1997). Percutaneous renal specimens were originally considered too small, but studies found as long as renal cortex with at least five glomeruli was present in the needle specimens, there was sufficient correlation both as to the type and severity of the lesions (Pirani, 1996). Due to advances in techniques, including visualisation of the kidneys, the procedure is considered safer and complications decreased (Nelson et al., 2001).

The purpose of renal biopsy

Renal biopsy refers to the removal of living tissue from the cortex of the kidney to examine changes to the capillary endothelium, basement

Key Words

renal, biopsy, nursing, kidney

membrane, mesangial cells and epithelial cells for examination under a microscope (Terrill, 2002). The renal cortex tissue is obtained to determine diagnosis, extent of renal disease and choice of treatment (Cross & Jayne, 2005, Appel, 1996, Richard, 2001, Pirani, 1996) and to better understand the pathophysiology of renal disease (Schelling & Tamarkin, 2003). Renal biopsy can be performed for one-time examination or serially to monitor the progress of a disease (Matassarín-Jacobs, 1997). It is usually conclusive and limits the need for other diagnostic studies (Schelling & Tamarkin, 2003). Closed percutaneous biopsies of the transplanted kidney are undertaken to see if the cause is nephrotoxicity with a need to decrease immunotherapy, or rejection, with a need to increase immunotherapy (Mahon & Hattersley, 2002, Terrill, 2002).

The indications for renal biopsy

Indications for renal biopsy include unexplained acute renal failure, persistent proteinuria (>2g/24 hours), haematuria, glomerulopathies, nephrotic syndrome and suspected renal involvement in a systemic disease (Appel, 1996, Richard, 2001, Mahon & Hattersley, 2002, Schelling & Tamarkin, 2003, Tomson & Plant, 1997). The procedure is also indicated when diagnosis cannot be confirmed, where renal impairment is a known complication of a specific disease. Examples are diabetes, or following a

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renal transplantation to differentiate between nephrotoxicity or rejection (Terrill, 2002). Renal biopsy should only be performed if the risks can be justified by the benefits of accurate diagnosis (Tomson & Plant, 1997). Contraindications are described in Table 1.

The renal biopsy procedure

Management of renal biopsy is multi-disciplinary. As with any invasive procedure the assessment of the risks against the benefits of the procedure is required (Appel, 1996). People undergoing biopsy require an explanation of the procedure and post

procedure care, including discussion that pain may be felt when needle enters the kidney and responsibilities such as position and holding breath (Richard, 2001). Anticoagulant therapy should be ceased appropriately to prevent bleeding (Jamieson et.al., 1997). Before the procedure the patient should have blood

Table 1 Contraindications for Renal Biopsy

Contraindication	Reason
Thrombocytopenia, uncorrected platelet dysfunction, bleeding or coagulation disorders, haemorrhagic tendencies	Risk of bleeding (Field, Pollock & Harris, 2001, Terrill, 2002, Schelling & Tamarkin, 2003, Mahon & Hattersley, 2002, Matassarini-Jacobs, 1997)
Perinephric abscess or pyelonephritis	Subsequent abscess development (Terrill, 2002, Schelling & Tamarkin, 2003)
Uncooperative client or impaired mental function	Unable to follow instructions, may need sedation (Terrill, 2002, Schelling & Tamarkin, 2003, Mahon & Hattersley, 2002, Matassarini-Jacobs, 1997)
Documented renal neoplasm/tumor	Dissemination risk (Terrill, 2002, Matassarini-Jacobs, 1997)
Uncontrolled hypertension (>160/95)	Highly vascular kidney can easily haemorrhage even with normal clotting times (Terrill, 2002, Schelling & Tamarkin, 2003, Mahon & Hattersley, 2002, Matassarini-Jacobs, 1997)
Solitary kidney	Uncontrolled bleeding may lead to nephrectomy or urinary tract obstruction from a blood clot may result in renal failure (Terrill, 2002, Schelling & Tamarkin, 2003, Mahon & Hattersley, 2002, Matassarini-Jacobs, 1997)
Gross sepsis	Infection risk (Matassarini-Jacobs, 1997)
Kidney is not clearly visible on ultrasound	Risk of damage to kidney and surrounding structures (Terrill, 2002)
Small shrunken kidney	Difficult,; a sign of existing disease, no benefit (Terrill, 2002, Mahon & Hattersley, 2002)
Large polycystic kidney	Cyst rupture or bleed (Appel, 1996)
Hydronephrosis	Increased risk of bleeding or urine leak (Matassarini-Jacobs, 1997)
Urinary tract infection	Infection risk (Matassarini-Jacobs, 1997)
Gross obesity	Technically difficult (Mahon & Hattersley, 2002)
Frequent coughing / sneezing	Ability of patient to hold breath (Richard, 2001)
Severe anaemia	Risk of bleeding (Mahon & Hattersley, 2002)
Multiple renal artery aneurysms	Rupture (Appel, 1996)
When clinical and other laboratory features can be highly suggestive of a diagnosis	Unnecessary (Field, Pollock & Harris, 2001, Mahon & Hattersley, 2002)
Unlikely to lead to a change in therapy	Unnecessary (Field, Pollock & Harris, 2001)
When the chance of complication outweighs the risk	Unnecessary (Field, Pollock & Harris, 2001)

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samples taken for baseline haematologic and renal function evaluations, coagulation studies, and group and cross-matching. (Mahon & Hattersley, 2002, Schelling & Tamarkin, 2003, Matassarini-Jacobs, 1997, Jamieson, McCall, Blythe & Whyte, 1997).

Kidney position, depth, kidney function and that kidney size should be determined by ultrasound prior to kidney biopsy (Harrington, 1997). Vital signs and urination should be done before the biopsy as a baseline, and sedation can be administered if required (Richard, 2001). There are variations in oral intake policy range from nil by mouth the night before (Richard, 2001), nil by mouth 6–8 hours prior to procedure (Matassarini-Jacobs, 1997, Schelling & Tamarkin, 2003) to no requirement to fast. (Webster & Allan, 2002)

Preference of which kidney to be biopsied can be determined by ultrasound, selecting the most accessible side. Some texts suggest the left kidney is preferred for biopsy as the liver is on the right, and as the majority of people are right handed it is more accessible. However, Terrill (2002) says the preferred biopsy site is the lateral border on the lower pole of the right kidney, due to the presence of the spleen, pancreas and stomach on the left.

For a native kidney biopsy, the patient lays prone, usually with a pillow under the abdomen to make the kidney more superficial. The specimen is most often obtained by closed percutaneous puncture where a 'core' of tissue is obtained under local anaesthesia via a biopsy gun. Transplanted kidney biopsy procedure is similar but due to the position in the lower abdomen and more superficial placement of the kidney, the patient lays supine (Terrill, 2002, Mahon & Hattersley, 2002). Open biopsy is performed under general anaesthesia where a surgical incision is made, wedges of tissue are taken and is usually reserved for high risk patients (Terrill, 2002, Richard, 2001, Matassarini-Jacobs, 1997).

Ultrasound has been used since the late 1970's (Appel, 1996). Use of aseptic technique is required and the procedure takes about forty minutes to one hour.

The needle entry site is marked after locating and checking the depth of the kidney by ultrasound (Figure 1) using a needle-guidance device or freehand technique (Terrill, 2002). This allows real-time visualization (Schelling & Tamarkin, 2003). The area is cleaned using aseptic technique and considered sterile. Local anesthetic is used and a small hole is cut in the skin. A spinal needle is placed through the skin and more local is inserted when the needle is pressed against the capsule of the kidney when viewed by ultrasound (Mahon & Hattersley, 2002, Tomson & Plant, 1997). The needle is observed for swinging as the patient breathes, to confirm needle placement at the renal capsule (Terrill, 2002, Richard, 2001) as the kidney is anchored to surrounding structures and abdominal wall, and therefore moves with the diaphragm (Tortora & Grabowski, 2003). The patient usually can feel pain or intense pressure as the needle enters the renal capsule (Richard, 2001). The spinal needle is then withdrawn, and a renal biopsy needle or disposable automated spring-loaded device is inserted along the pathway made by the spinal needle (Mahon & Hattersley, 2002). The length of specimen notch is 1.9cm, and different cartridge gauge sizes (14–18G) and needle lengths are available. Using ultrasound and biopsy instrument simultaneously, the biopsy needle is gradually directed into the lower pole cortex of the kidney (Schelling & Tamarkin, 2003, Tomson & Plant, 1997). It is necessary to view the ultrasound to confirm biopsy instrument placement before specimen is obtained. The patient is asked to hold their breath for a few seconds each time a cortex specimen is being obtained (Mahon & Hattersley, 2002, Matassarini-Jacobs, 1997, Tomson & Plant, 1997) to prevent movement of the kidney.

The cortical tissue is placed in normal saline (Figure 2) immediately within minutes to ensure preservation of the tissue (Mahon & Hattersley, 2002, Schelling & Tamarkin, 2003). A floating specimen indicates the sample external capsule is fat, not renal cortical tissue, and therefore is not suitable. Ultrasound is undertaken after the last specimen is collected to check for haematoma. A non-occlusive dressing is placed over site and patient is instructed to lie flat on their back for four hours to reduce the risk of bleeding by use of body's own compression, with regular observations to be attended (Mahon & Hattersley, 2002, Schelling & Tamarkin, 2003). A sandbag is may be used for compression on a transplanted kidney.

Nursing management of renal biopsy

To ensure optimal care and safety is provided to patients undergoing renal biopsy, nursing staff have a role in the management of patients undergoing this procedure. Nurses may assist in the preparation of the patient for the procedure taking baseline observations, assisting with patient gown, ensuring full understanding and consent, pre-biopsy bloods, and post biopsy care (Jamieson et.al., 1997).

Following native kidney biopsy, the patient is instructed to remain flat on back immediately after the procedure then bedrest and avoid straining for 24 hours (Terrill, 2002, Mahon & Hattersley,

Figure 1. Kidney Ultrasound. Photo Kelly Burgoyne.

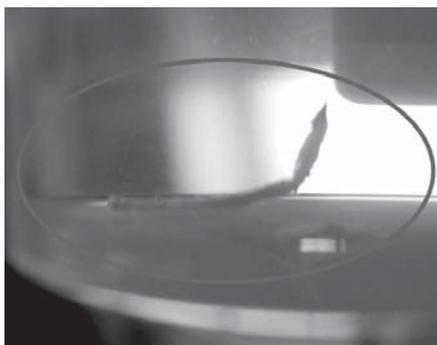


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2002, Matassarín-Jacobs, 1997). A sandbag may be used for compression on renal transplant site. Post biopsy observations may vary with according to each institution to detect intrarenal and or extrarenal bleeding and infection. Observations may be half hourly blood pressure and pulse, and biopsy check for one hour, then hourly blood pressure and pulse, and biopsy check for four hours, then four hourly blood pressure and pulse, and biopsy check for the next 24–48 hours (Terrill, 2002, Richard, 2001, Mahon & Hattersley, 2002, Schelling & Tamarkin, 2003, Matassarín-Jacobs, 1997). There is limited evidence in the literature to support any one policy.

Nursing assessment for other signs and symptoms of internal bleeding include changes in blood pressure, tachycardia, pallor, dizziness, light-headedness, decrease haemoglobin, pain and blood stained urine (Richard, 2001, Mahon & Hattersley, 2002). Nurses should assess the puncture site for bleeding or infection (Terrill, 2002, Richard, 2001, Matassarín-Jacobs, 1997) and assess pain. Appropriate administration and evaluation of analgesics is important (Richard, 2001, Matassarín-Jacobs, 1997). Collection of serial urine specimens measuring volume and to evaluate haematuria with dipstick for 24 to 48 hours (Terrill, 2002, Richard, 2001, Mahon & Hattersley, 2002, Matassarín-Jacobs, 1997) can be done for those patients on the ward. Haemoglobin should be measured

Figure 2. Cortical Tissue in Saline.
Photo Kelly Burgoyne.



4–6 hours after to assess changes in baseline (Schelling & Tamarkin, 2003). Patients must be instructed to drink liberal amounts of fluids or administer intravenous fluids to maintain a dilute urine and prevent intrarenal clot formation (Terrill, 2002, Richard, 2001, Matassarín-Jacobs, 1997).

Other nursing roles are education and assistance with splinting the puncture site to decrease discomfort with breathing (Richard, 2001), emotional and psychological support while waiting for results and its implications (Richard, 2001), documenting and reporting any abnormalities immediately (Jamieson et al., 1997), educating the patient to avoid strenuous activity for 2 weeks, and awareness that bleeding can develop several days after the biopsy (Terrill, 2002, Mahon & Hattersley, 2002, Schelling & Tamarkin, 2003, Matassarín-Jacobs, 1997).

Complications

Complications are less common with the use of ultrasound guidance (Tomson & Plant, 1997), however, they still occur. Renal nurses need to be aware of the complications for early identification and management. Complications may include: infrequent damage to surrounding structures consisting of inadvertent biopsy of neighboring organs (spleen, liver, pancreas) or blood vessels; flank or abdominal pain; anuria; hypotension and dizziness; decreasing haemoglobin or blood transfusion (occasional); infection (uncommon); aneurysm; persistent (>2–3 weeks) or gross haematuria; perinephric haematoma; perirenal or intrarenal arteriovenous fistula; haemorrhage; haematoma; transplant graft loss; selective embolism and death. (Terrill, 2002, Appel, 1996, Richard, 2001, Mahon & Hattersley, 2002, Schelling & Tamarkin, 2003, Matassarín-Jacobs, 1997, Tomson & Plant, 1997, Harrington, 1997).

The results of renal biopsy

Biopsy from renal cortex should contain a

minimum of 6–8 glomeruli, normally two samples are enough for the different slide preparations (Schelling & Tamarkin, 2003). Renal biopsy samples should be delivered immediately to the laboratory (Mahon & Hattersley, 2002) to ensure freshness of specimen. Results of the biopsy will show characteristics of the lesions: acute or chronic, active or inactive, reversible or irreversible (Pirani, 1996). Abnormalities may be segmental (involving part of a glomerulus only), global (involving the whole glomerulus), focal (involving only a few glomeruli only) or diffuse (involving most glomeruli) (Terrill, 2002, Field et al., 2001).

In the laboratory, specimens are prepared for three different slide preparations. The cellular changes that occur with renal disease are examined after the biopsy using light microscopy (LM), electron microscopy (EM) and immunofluorescence (IF) (Walker, Cavallo & Bonsib, 2004). For transplant allograft biopsies often IF and EM are omitted unless there is clinical suspicion of recurrent disease (Walker et al., 2004). Each of the diagnostic techniques requires a different sample, submitted in a specific fixative (Appel, 1996). The biopsy specimen should be handled with care to avoid damage that may prevent an accurate diagnosis (Terrill, 2002). The pathologist requires good communication with the nephrologist to allow accurate correlation of clinical information with the observed pathologic process to achieve a correct diagnosis (Walker et al., 2004).

LM (Figure 3) visualizes the glomerulus, blood vessels, tubule cells, and interstitium (Field et al., 2001); using special stains H & E (hematoxylin-eosin) or methenamine-silver stain (Pirani, 1996). Information from LM demonstrates mesangial, epithelial, or endothelial proliferation, basement membrane changes, and the presence of necrosis, hyalinosis and sclerosis (Terrill, 2002). Magnification is 750 times (Richard, 2001).

EM (Figure 4) is undertaken using thinly

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sliced specimens to see identify glomerular epithelial cell podocytes, basement membrane, and site of electron-dense deposits (Field et. al., 2001). EM shows mesangial, subepithelial, subendothelial or intramembranous, and the nature of immunoglobulin or complement deposits (Terrill, 2002). As the magnification is 54,999 times (Richard, 2001), more structure of the kidney is seen. The image is in black and white (Pirani, 1996).

IF (Figure 5) looks at glomerular pattern, immunoglobulins, complement component and light chain (Field et. al., 2001). It differentiates between immune-complex disease and basement membrane disease, and more information about the precise location of these deposits (Terrill, 2002). IF identifies antigens and antibodies in renal tissue, immunologic and non-immunologic renal diseases (Pirani, 1996).

Conclusion and Implications for Renal Nursing

Renal nurses are regularly caring for patients undergoing renal biopsy. Nurses have a role in the management of patients undergoing renal biopsy, including preparing the patient for the procedure (baseline vitals, gown and patient notes, ensuring consent and bloods are done, anticoagulation ceased, the patient has fasted as ordered) and care following the procedure. Complications are less common following a renal biopsy due to the use of ultrasound guidance however, early identification and management of the complications of renal biopsy is a role of renal nurses.

This literature review failed to demonstrate that the nursing care practice of patients undergoing renal biopsy is evidence based. There is also a lack of evidence to demonstrate if patients require fasting and the frequency of observations post biopsy. Further research by nurses and multi-disciplinary teams is recommended to contribute to improved evidenced based nursing care.

Figure 3. Light microscopy renal biopsy image. Courtesy of SWSAHS Pathology

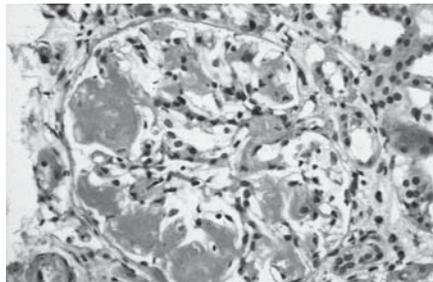


Figure 4. Electron microscopy renal biopsy image. Courtesy of SWSAHS Pathology

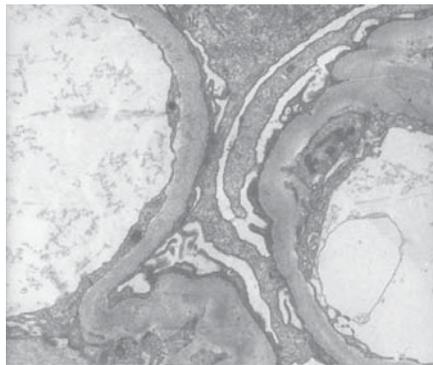
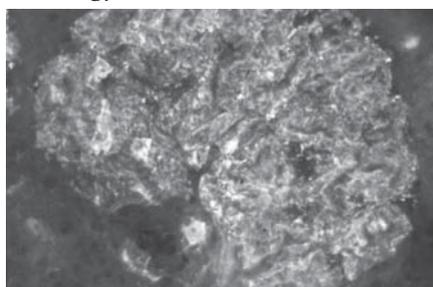


Figure 5. Immunofluorescence renal biopsy image Courtesy of SWSAHS Pathology



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