



6. POSITIONING FOR RENAL BIOPSY

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GUIDELINES

- a. We suggest the supine anterolateral position for obese patients or those with respiratory difficulty for native renal biopsy (2B).

UNGRADED SUGGESTIONS FOR CLINICAL CARE

- We recommend the prone position with a pillow or sandbag under the abdomen to splint the kidneys for native renal biopsy
- We recommend the supine position for transplant biopsy
- For exceptional situations (intubated, pregnant, and morbidly obese) we recommend any position which simultaneously optimizes view of the needle tip and kidney whilst maintaining patient comfort.
- Due to the lack of comparator trials it is impossible to make evidence based statements in regard to patient position for biopsy. The current standard, prone for native and supine for transplant has evolved through experience and practicality and is used to the extent that patient position is frequently not reported in renal biopsy studies.

IMPLEMENTATION AND AUDIT

1. All centres and proceduralists should maintain records of all percutaneous native and transplant renal biopsies in a real time manner.
2. Outcomes and complications should be reviewed in unit audits, at regular intervals and performance should be benchmarked to ensure safe practice.

BACKGROUND

Percutaneous renal biopsy is an important tool in the diagnosis of diseases affecting native and transplanted kidneys. Early percutaneous native renal biopsies were performed with the patient in the sitting position(1, 2) but soon the prone position on a sandbag or pillow to splint the kidneys was used which may improve patient comfort and tissue yield (3). In addition, use of a sandbag or pillow may also help to flatten the lumbar lordosis, making use of real time ultrasound easier. This has remained the standard or default position for percutaneous native renal biopsy to this day(4). Current literature does not describe patient positioning, suggesting it has been adopted as a standardised approach in several large renal biopsy series (5-9), although regional differences in practice may exist, such as the lateral decubitus position with a pillow under the contralateral flank which was employed in multiple Swedish centres in a series of 826 native biopsies (10). Overall, there is a paucity of comparative studies of patient position for native renal biopsy. The prone position may not be comfortable or even possible in some patient groups, including obese patients, those with significant respiratory compromise and pregnant women. The supine antero-lateral position (SALP) for obese and non-obese patients has



been reported to provide superior compliance, comfort and respiratory comfort assessed by visual analogue scale compared with the prone position (11). Biopsy of a renal transplant has been described exclusively with the patients in the supine position(10, 12), however like native kidney biopsy patient position in transplant biopsy is frequently not reported(13, 14).

SEARCH STRATEGY

Databases searched: MeSH terms and text words for kidney disease/failure or acute kidney injury were combined with MeSH terms and text words for biopsy. These were combined with MeSH terms and text words for a range of imaging modalities and limited to human subjects. The search was carried out in Ovid MEDLINE (1946 – May 2017), Embase (1974 – May 2017), the Cochrane Library (CENTRAL) and the Cochrane Kidney and Transplant Register of Studies (Inception – May 2017). The search strategy is provided in Appendix 1.

Date of search/es: March and May 2017

WHAT IS THE EVIDENCE?

Gesualdo *et al.*(2008) reported a single centre randomised controlled trial (RCT) with an observational component in 110 consecutive native renal biopsy patients. Ninety “low risk” patients (body mass index (BMI) \leq 30, and no respiratory difficulty) were randomised to the prone position (PP) (Group 1, $n=45$) or the supine antero-lateral position (SALP) (Group 2, $n=45$) and 20 patients considered “high risk” (BMI $>$ 30, and/or respiratory difficulty) were all biopsied in the SALP as an observational group (Group 3). All biopsies were performed by a trained nephrologist using real time ultrasound with a 16G automatic needle. There was no difference in: procedure time (overall mean 7 minutes), number of passes (overall median 2), number of cores (overall mean 2) and number of glomeruli obtained between the three groups (15.64 in Group 1 vs. 15.04 in Group 2 vs. 12.72 in Group 3). The overall complication rate was 12% with no difference between groups. One major complication, an arteriovenous fistula (AVF) requiring embolisation, occurred in group 1. One day prior to the biopsy procedure all patients were asked to assess comfort and respiratory difficulty after five minutes in both the PP and SALP by visual analogue scale (VAS). Patients in all three groups found the SALP to be more comfortable ($p<0.05$) and had reduced breathing difficulty ($p<0.001$) compared with the PP. There was no difference in pain scores either during the biopsy or 24 hours later between the three groups. The authors concluded renal biopsy in the SALP is reliable, easy and successful and resulted in superior VAS scores for comfort and respiratory difficulty making it particularly suitable for obese patients (11).

Peters *et al.*(2014) reported 1001 renal biopsies (826 native and 175 transplant) from multiple centres in Sweden. Data from six of the centres were prospective (640 native and 170 transplant) while data from a single centre was retrospectively obtained (186 native and 5 transplant). All native renal biopsies were performed with the patient lying on the side opposite to the kidney being biopsied with a pillow under the flank. All transplant biopsies were performed in the supine position. Women were at greater risk of all complications (12.2% vs. 6.5%, $p=0.003$) and major complications (9.6% vs. 4.5%, $p=0.002$) compared with men. Major complications were more common after biopsies from the right kidney, in women than in men (10.8% vs. 3.1%, $p=0.005$) and in patients of lower BMI (25.5 vs. 27.3kg/m², $p=0.016$) and younger age (45 vs 52.5 years, $p=0.001$). The authors concluded attention should be paid to right-sided native kidney biopsies especially in women, those with lower BMI and of younger age(10).

An older paper from Goldsmith *et al.* (1966) reported outcomes following 164 biopsies in the sitting position after skin marking based on an X-Ray. Twenty-six biopsies (16%) failed to produce diagnostic tissue, and liver was inadvertently obtained in five cases, spleen in two and colon in one case. There was no description of the type of needle, number of passes, or complications. The authors felt there was insufficient evidence for widespread adoption but commented on the increased comfort especially in acutely ill patients.



Laute *et al.*(2013) described 282 transplant surveillance biopsies. Two cores were taken with a 16G spring loaded needle under real-time ultrasound guidance on each occasion and all patients were in the supine position. Complications occurred in 6% of biopsies; there were no major complications. The median number of glomeruli obtained was 9, with 70% of biopsies meeting the adequacy criteria of 7 glomeruli and 1 artery (12).

SUMMARY OF THE EVIDENCE

Native renal biopsy has been described historically in the sitting position, and more recently the prone position with a sandbag, pillow or towel under the abdomen to splint the kidneys. The lateral decubitus position has also been described. However, there are no direct comparisons between these positions and most recent large renal biopsy series do not describe patient position. There is a single small RCT which found the supine antero-lateral position superior to the prone position with respect to patient compliance comfort and respiratory difficulty by visual analogue scale. Transplant biopsies are performed in the supine position.

WHAT DO THE OTHER GUIDELINES SAY?

Kidney Disease Outcomes Quality Initiative: No recommendation.

UK Renal Association: No recommendation.

Canadian Society of Nephrology: No recommendation.

European Best Practice Guidelines: No recommendation.

International Guidelines: No recommendation.

SUGGESTIONS FOR FUTURE RESEARCH

There is a paucity of studies directly comparing the “default” prone position with sitting, lateral decubitus position or the supine anterolateral position, especially in obese patients or those with respiratory difficulties. Outcomes of interest should include patient related outcomes such as comfort and pain, technical outcomes such as success rate, time taken to complete the procedure, biopsy adequacy, number of passes and complication rates and operator experience of the new technique.

The prone native kidney biopsy position has not been directly compared except to the SALP. Advantages of the SALP position should be confirmed. Comparison of the prone to the lateral decubitus position should also be compared.

Transplant biopsy has only been described in the supine position; other positions may be more suitable for certain patient categories, such as the obese.

Exploratory observational studies in different settings and in predefined groups, such as obese patients, may provide evidence and a rationale for designing prospective studies comparing patient position in the setting of renal biopsy for native and transplant kidneys.

CONFLICT OF INTEREST

Saunders J, Wong J, Manera K, Champion de Crespigny P, Gutman T, Lopez-Vargas P, Menahem S, See E, Voss D and MacGinley R and have no relevant financial affiliations that would cause a conflict of interest according to the conflict of interest statement set down by KHA-CARI.



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APPENDICES

Table 1. Characteristics of included studies

Study ID (author, year)	N*	Study design	Setting	Participants	Group of interest/ experimental group	Comparison group/ control group	Outcomes
Gesualdo et al (2008)(11)	n=110 patients n=110 biopsies	RCT with prospective (groups 1 and 2) observational group (group 3)	Single centre, Italy	Group1: low risk patients (BMI ≤ 30, no respiratory difficulty) BMI average 23.9 ± 3.0, aged 45.1 ± 7.9 years) Group2: low risk patients (BMI ≤ 30, no respiratory difficulty) BMI average 25.2 ± 2.3, aged 44.8 ± 16.1 years) Group3: high risk patients (BMI ≥ 30 and/or respiratory difficulty) BMI average 36.5 ± 6.3, aged 48.8 ± 13.9 years) BMI in group 3 significantly higher than groups 2 and 3 (p<0.001), other baseline characteristics similar	Group 2 (n=45) and Group 3(n=20) Supine antero-lateral position (SALP), inferior renal pole ultrasound guided with 16G automatic biopsy needle DDAVP and antibiotics administered prophylactically 24hours before procedure.	Group 1 (n=45) Prone position, ultrasound guided DDAVP and antibiotics administered prophylactically 24 hours before procedure.	<ul style="list-style-type: none"> • Procedure time • Number of passes • Number of cores • Adequacy • Complications
Peters et al (2014)(10)	n=1001 biopsies n=917 patients	prospective and retrospective observational study	Multi-centre, Sweden Jan 2006 - March 2013	female: n=352, male n=565 median age: 54 years (16-90 years)	Native (n=826): turned on side opposite to the biopsies kidney with a pillow under the flank. Real time ultrasound guidance with springloaded biopsy device with 14G/16G/18G/20G needles. Tx(n=175): Supine position, Real time ultrasound guidance with springloaded biopsy device with 16G/18G	N/A	<ul style="list-style-type: none"> • Number of passes • Complications

Study ID (author, year)	N*	Study design	Setting	Participants	Group of interest/ experimental group	Comparison group/ control group	Outcomes
					needles.		
Goldsmith et al (1966)(2)	n=164 biopsies	Retrospective observational study	Single centre, UK	No information	Sitting position, feet resting on a chair seat, arms folded on a pillow on the lap, spine perpendicular to thighs and shoulders bowed. X-ray localised either kidney.	N/A	<ul style="list-style-type: none"> • Rate of failure • Adequacy • Complications
Laute et al (2013)(12)	n=282 biopsies, n= 248 patients	retrospective observational	Single centre, Belgium Jan 2006 - Dec 2011	Tx patients	Supine position, upper or lower pole of kidney 16G springloaded biopsy gun (Bard) with real time ultrasound guidance, performed by one operator.	N/A	<ul style="list-style-type: none"> • Adequacy • Number of cores • Complications

*N = patients unless otherwise specified. Tx = transplanted kidney

Table 2. Risk of bias – controlled studies (Cochrane Risk of Bias Tool)

Study ID	Study type	Selection Bias		Performance Bias	Detection Bias	Outcome assessment			Reporting Bias	Other risks of Bias	Quality
		Random sequence	Allocation concealment	Blinding of participants & personnel	Blinding of outcome assessors	Incomplete data	Assessed blindly	Switching interventions	Selective reporting		
Gesualdo et al (2008)(11)	RCT + observational cohort	Low	Unclear	Unclear	Unclear	Low	Unclear	Low	Low	Unclear	Low

Table 3. Risk of bias- Other studies

Study ID	N	Study type	Quality	Comments
Peters et al (2014)(10)	n=1001 biopsies n=917 patients	Prospective and Retrospective observational study	Low	No quality appraisal tool available; large sample size, multi-centre
Goldsmith et al (1966)(2)	n=164 biopsies	Retrospective observational study	Very low	No quality appraisal tool available.
Laute et al (2013)(12)	n=282 biopsies, n= 248 patients	Retrospective observational	Very low	No quality appraisal tool available.

Table 4. Outcomes – Procedure time (undefined)

Study ID	N	Study type	Intervention	Outcome	Results	Quality
Gesualdo et al (2008)(11)	n=110 patients n=110 biopsies	RCT with prospective (groups 1 and 2) observational group (group 3)	Group 1 (n=45): Prone position, ultrasound guided DDAVP and antibiotics administered prophylactically 24hours before procedure. Group 2 (n=45) and Group 3(n=20): Supine antero-lateral position (SALP), inferior renal pole ultrasound guided with 16G automatic biopsy needle DDAVP and antibiotics administered prophylactically 24hours before procedure.	Procedure time	Overall: mean time = 7 minutes, range 5-9 Group1: 6.8 ± 0.6 Group2: 7.0 ± 0.5 Group3: 6.8 ± 0.8 No differences between groups.	Low

Table 5. Outcomes – Number of passes

Study ID	N	Study type	Intervention	Outcome	Results	Quality
Gesualdo et al (2008)(11)	n=110 patients n=110 biopsies	RCT with prospective (groups 1 and 2) observational group (group 3)	Group 1 (n=45): Prone position, ultrasound guided DDAVP and antibiotics administered prophylactically 24hours before procedure. Group 2 (n=45) and Group 3(n=20): Supine antero-lateral position (SALP), inferior renal pole ultrasound guided with 16G automatic biopsy needle DDAVP and antibiotics administered prophylactically 24hours before procedure.	Number of passes	Group1: median:2, range: 1-4 Group2: median:2, range: 1-3 Group3: median:2, range: 1-3 No differences between groups.	Low
Peters et al (2014)(10)	n=1001 biopsies n=917 patients	prospective and retrospective observational study	Native (n=826): turned on side opposite to the biopsies kidney with a pillow under the flank. Real time ultrasound guidance with spring loaded biopsy device with 14G/16G/18G/20G needles Tx(n=175): Supine position, Real time ultrasound guidance with spring loaded biopsy device with 16G/18G needles	Number of passes	Native: median=2, range: 1-7 Tx: median=3, range 1-6	Low

Table 6. Outcomes – Number of cores

Study ID	N	Study type	Intervention	Outcome	Results	Quality
Gesualdo et al (2008)(11)	n=110 patients n=110 biopsies	RCT with prospective (groups 1 and 2) observational group (group 3)	Group 1 (n=45): Prone position, ultrasound guided DDAVP and antibiotics administered prophylactically 24hours before procedure. Group 2 (n=45) and Group 3(n=20): Supine antero-lateral position (SALP), inferior renal pole ultrasound guided with 16G automatic biopsy needle DDAVP and antibiotics administered prophylactically 24hours before procedure.	Number of cores	Group1: median:2, range: 1-2 Group2: median:2, range: 1-2 Group3: median:2, range: 1-2 No differences between groups.	Low
Laute et al (2013)(12)	n=282 biopsies, n= 248 patients	retrospective observational	Supine position, upper or lower pole of kidney 16G springloaded biopsy gun (Bard) with real time ultrasound guidance, performed by one operator	Number of cores	N=2	Very low

Table 7. Outcomes – Adequacy

Study ID	N	Study type	Intervention	Outcome	Results	Quality
Gesualdo et al (2008)(11)	n=110 patients n=110 biopsies	RCT with prospective (groups 1 and 2) observational group (group 3)	Group 1 (n=45): Prone position, ultrasound guided DDAVP and antibiotics administered prophylactically 24hours before procedure. Group 2 (n=45) and Group 3(n=20): Supine antero-lateral position (SALP), inferior renal pole ultrasound guided with 16G automatic biopsy needle DDAVP and antibiotics administered prophylactically 24hours before procedure.	Adequacy	100% adequate samples and diagnostic yield Mean glomeruli per core: Group1: 15.6 ± 5.8 Group2: 15.0 ± 6.8 Group3: 12.7 ± 4.4 No differences between groups.	Low
Laute et al (2013)(12)	n=282 biopsies, n= 248 patients	retrospective observational	Supine position, upper or lower pole of kidney 16G springloaded biopsy gun (Bard) with real time ultrasound guidance, performed by one operator	Adequacy	Median number of glomeruli: 9 (range 0-39) 7+ glomeruli & 1 artery: 70% 10+ glomeruli & 2 arteries: 48%	Very low
Goldsmith et al (1966)(2)	n=164 biopsies	Retrospective observational study	Sitting position, feet resting on a chair seat, arms folded on a pillow on the lap, spine perpendicular to thighs and shoulders bowed. X-ray localised either kidney	Adequacy	84% (n=138), 67% (n=110) yielded 10+ glomeruli per section 0 glomeruli: n=26 1-4 glomeruli: n=5 5-10 glomeruli: n=17 11-20 glomeruli: n=70 20+ glomeruli: n=46	Very low

Table 8. Outcomes – Complications

Study ID	N	Study type	Intervention	Outcome	Results	Quality
Gesualdo et al (2008)(11)	n=110 patients n=110 biopsies	RCT with prospective (groups 1 and 2) observational group (group 3)	Group 1 (n=45): Prone position, ultrasound guided DDAVP and antibiotics administered prophylactically 24hours before procedure. Group 2 (n=45) and Group 3(n=20): Supine antero-lateral position (SALP), inferior renal pole ultrasound guided with 16G automatic biopsy needle DDAVP and antibiotics administered prophylactically 24hours before procedure.	Complications	Overall: 12% (n=13) Minor: n=12 Group1: 13.3% (n=6), Group2: 8.9% (n=4), Group3: 10% (n=2) Major: n=1 - AVF requiring chemoembolisation - Group 1 No significant difference between groups. Comfort and breathing difficulty of each position measured in each participant before procedure: Significantly better comfort (p<0.05) and lower breathing difficulty (p<0.001) in SALP than prone position in low and high risk patients.	Low
Peters et al (2014)(10)	n=1001 biopsies n=917 patients	prospective and retrospective observational study	Native (n=826): turned on side opposite to the biopsies kidney with a pillow under the flank. Real time ultrasound guidance with spring loaded biopsy device with 14G/16G/18G/20G needles Tx(n=175): Supine position, Real time ultrasound guidance with spring loaded biopsy device with 16G/18G needles	Complications	All/Native/Tx Overall: 8.7%/9.1%/6.9% Major: 6.5%/7%/2.1% Minor: 2.2%/2.1%/2.9% Women were at greater risk of overall complications than men (12.2% vs. 6.5%; P=0.003; OR: 2.0; CI: 1.3–3.1) as well as of major complications (9.6% vs. 4.5%; P=0.002; OR: 2.2, CI: 1.3–3.7). Major complications occurred more commonly after biopsies from the right kidney, in women than in men (10.8% vs. 3.1%; P=0.005; OR: 3.7; CI: 1.5–9.5), and in patients with lower BMI (25.5 vs. 27.3, P=0.016) and of younger age (45 years vs. 52.5 years; P=0.001). Lower mean arterial pressure in transplant kidney biopsies indicated a risk of major complications (90 mmHg vs. 98 mmHg; P=0.039). Factors such as needle size, number of passes, serum creatinine, and eGFR did not influence complication rates.	Low
Laute et al (2013)(12)	n=282 biopsies, n= 248 patients	retrospective observational	Supine position, upper or lower pole of kidney 16G springloaded biopsy gun (Bard) with real time ultrasound guidance, performed by one operator	Complications	No major complications (requiring intervention) Minor: 6% (n=17) including 3.5% macroscopic haematuria (n=10) and 2.1% pain from haematoma (n=6)	Very low
Goldsmith et al (1966)(2)	n=164 biopsies	Retrospective observational study	Sitting position, feet resting on a chair seat, arms folded on a pillow on the lap, spine perpendicular to thighs and shoulders bowed. X-ray localised either kidney	Complications	No blood transfusions or surgical interventions required	Very low

Table 9. Outcomes – Rate of failure

Study ID	N	Study type	Intervention	Outcome	Results	Quality
Goldsmith et al (1966)(2)	n=164 biopsies	Retrospective observational study	Sitting position, feet resting on a chair seat, arms folded on a pillow on the lap, spine perpendicular to thighs and shoulders bowed. X-ray localised either kidney	Rate of failure	16% (n=26) failed to produce diagnostic amounts of renal cortex n=12 - medulla only n=5 - liver n=2 - spleen n=1 - colon n=8 - muscle/fat/no tissue	Very low

Appendix 2. Search Strategy

Renal Biopsy – Positioning Search Strategy MeSH terms
1. kidney diseases/
2. exp Renal Replacement Therapy/
3. Renal Insufficiency/
4. exp Renal Insufficiency, Chronic/
5. Diabetic nephropathies/
6. exp hypertension, renal/
7. (kidney disease* or renal disease* or kidney failure or renal failure).tw.
8. (ESRF or ESKF or ESRD or ESKD).tw.
9. (CKF or CKD or CRF or CRD).tw.
10. (pre-dialysis or predialysis).tw.
11. exp acute kidney injury/
12. (acute kidney failure or acute renal failure).tw.
13. (acute kidney injur\$ or acute renal injur\$).tw.
14. (acute kidney insufficie\$ or acute renal insufficie\$).tw.
15. acute tubular necrosis.tw.
16. (ARI or AKI or ARF or AKF or ATN).tw.
17. or/1-16
18. biopsy/
19. renal biops\$.tw.
20. kidney biops\$.tw.
21. or/18-20
22. 17 and 21
23. sitting.tw.
24. orientation.tw.
25. direction.tw.
26. cranial.tw.
27. caudal.tw.
28. exp breath holding/ or exp exhalation/ or exp inhalation/
29. left kidney.tw.
30. right kidney.tw.
31. position\$.tw.
32. exp Posture/
33. 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32
34. 22 and 33
35. limit 34 to humans