# Fractional Excretion of Sodium (FENa)

## INPUTS

|  |  |
| --- | --- |
| Serum sodium | **Options:** |
| Serum creatinine | **Options:** |
| Urine sodium | **Options:** |
| Urine creatinine | **Options:** |

## FORMULA

Fractional Excretion of Sodium (FENa), % = 100 × (SCr × UNa ) / (SNa × UCr)

SCr, serum creatinine; UNa, urine sodium; SNa, serum sodium; UCr, urine creatinine.

How the equation is derived:

* FENa is a measure of tubular resorption of Na.
* FENa = (Na excreted/Na filtered) x 100.
* Na excreted = UNa × urine volume.
* Therefore, Na filtered = PNa × (UCr × urine volume)/PCr.

## FACTS & FIGURES

|  |  |  |  |
| --- | --- | --- | --- |
|  | Pre-Renal | Indeterminate | Intrinsic |
| FENa | <1% | 1-2% | >2% |
| UNa (mmol/L) | <20 | 20-40 | >40 |

**Pre-Renal:** Anything causing decreased effective renal perfusion: hypovolemia, heart failure, renal artery stenosis, sepsis, etc. Remember, contrast-induced nephropathy will often look pre-renal.

**Intrinsic:** ATN, AIN, glomerulonephritides, etc.

## EVIDENCE APPRAISAL

[Espinel in 1976](https://www.ncbi.nlm.nih.gov/pubmed/947239) originally described a FENa cutoff of <1% for pre-renal azotemia in a study study of 17 adults with oliguria, defined as urine output <20mL/hr.  Patients with urinary obstruction, acute glomerulonephritis, CKD, and diuretic use were excluded.

A FENa cutoff of <1% for pre-renal azotemia was clinically validated in a prospective study, though there was overlap between patients with true pre-renal azotemia and acute tubular necrosis.  Specificity for pre-renal azotemia (with a cutoff of <1%) was decreased in non-oliguric acute renal failure ([Miller 1978](https://www.ncbi.nlm.nih.gov/pubmed/666184)).

At a normal GFR of 180 L/day and Na concentration of 140 mEq/L, the filtered sodium load is 25,200 mEq/day (=140 × 180). A FENa of 1% in this setting represents sodium excretion of 252 mEq/day.  This is higher than the average sodium intake of 80 to 250 mEq/day. This is the physiologic basis for hypothesizing that patients with normal GFR have a FENa below 1%.