Take home message for metabolic alkalosis and Hyponatremia cases:

1. In metabolic alkalosis, expected $pCO_2 = 0.7 [HCO_3] + 20$ mmHg (range: +/- 5). See the attached articled on Simple and Acid-Base disorders by Narins and Emmett.
2. Increased anion gap (2-3 points at the most) occurs in severe alkalemia through several mechanisms:
    a. Excess alkali strips [H+] from albumin. Albumin is negatively charged (anion) and hence increases anion gap slightly.
    b. Phosphofructokinase enzyme activity in glycolytic pathway is pH dependent. Alkalemia stimulates PFK while acidemia inhibits the enzyme. Alkalemia stimulates the pathway resulting in higher production of lactate from pyruvate. This lactate contributes to anion gap Reference attached.
3. Excessive alkali intake or acid loss triggers the development of metabolic alkalosis. In ESRD patient, alkalosis is difficult to treat due to the loss of renal compensation mechanism. The effective therapy includes low bicarb dialysate and dilutional acidosis intentionally caused by infusion of bicarbonate-free fluid (0.9% NS) during dialysis along with parallel same volume ultrafiltration of bicarbonate-rich fluid.
4. The treatment of complicated acid-base disorder cases should focus on correction of pH, instead of pCO_2 or bicarbonate concentration.
5. Decreased excretion of electrolyte-free water in urine is the major reason for hyponatremia.
6. In decompensated liver or heart failure patients, the total sodium content is high. The development of hyponatremia is related to excessive fluid retention (dilutional effect) instead of depletion of sodium content. Important to differentiate Na content from Na concentration.
7. Third spacing of volume (eg. Ascites) leads to decreased effective arterial blood volume (EABV) and ADH release, which causes sodium retention, edema.
8. Be alert of sodium loss in large volume paracentesis. The content of sodium can be measured in ascites fluid.
9. Calculate sodium concentration changes when using 3% NaCl (513meq/L) to treat hyponatremia.
10. 25% albumin contains 154meq/L sodium, for example: 100ml 25% albumin contains 25gm albumin and 15.4meq sodium.
11. 1 gm Sodium tablet contains 17.2 meq sodium (1000/58), 10gm sodium tablet contains 172 meq sodium, almost 1/3 amount of one liter 3% NaCl. And GI absorption of sodium tablet is likely decreased in chronic ill patients.
12. Although Tolvaptan is not routinely used in liver cirrhosis patients, some transplant centers use it short-term to quickly improve hyponatremia prior to liver transplantation. Vaptans may worsen hypotension, worsen liver function, and increase the risk of variceal bleeding.