Similar to secondary prophylaxis, antibiotic alternatives to norfloxacin, such as ciprofloxacin, rifaximin, and sulfamethoxazole/trimethoprim, have been studied, including a number of meta-analyses.[210-212] Altogether, the studies are of variable quality and considered insufficient to support a consensus guidance recommendation. Thus, evidence for primary prophylaxis with antibiotics is not strong and is restricted to patients with very advanced cirrhosis. SBP prophylaxis should be individualized based on estimated risks and benefits with the patient characteristics and the limited data on various antibiotics taken into account. For example, a hospitalized patient in whom LT is imminent would be a good candidate for prophylaxis, and ciprofloxacin would be a reasonable choice. However, the growing concerns regarding the safety profile of fluoroquinolones that have led to restrictions/warnings by both the US Food and Drug Administration and European Medicines Agency[213] must be kept in mind.

Guidance Statement

- Patients who have recovered from an episode of SBP should receive long-term prophylaxis with daily norfloxacin. In settings in which norfloxacin is unavailable, oral ciprofloxacin is acceptable.
- Antibiotic prophylaxis for SBP should be instituted in patients with cirrhosis and upper gastrointestinal hemorrhage. IV ceftriaxone 1 g/24 hours is the antibiotic of choice and should be used for a maximum of 7 days.
- In patients with cirrhosis and low protein (<1.5 g/L) ascites, primary SBP prophylaxis can be considered in selected patients with renal dysfunction (serum creatinine level >1.2 mg/dL, blood urea nitrogen level >25 mg/dL, or serum sodium level <130 mEq/L) or liver failure (Child-Turcotte-Pugh score >9 and bilirubin >3 mg/dL).

INFECTIONS NOT UNIQUE TO CIRRHOSIS

Diagnostic criteria for non-SBP infections (e.g., pneumonia, cellulitis) should, in general, follow the guidelines for the general population, stratified by the risk of having an infection due to a MDRO. In a randomized trial of patients with advanced cirrhosis and non-SBP infections, albumin infusion did not improve in-hospital mortality.[214] In patients with non-SBP infections, AKI may develop, which should be managed accordingly.

AKI and HRS

DEFINITION AND EPIDEMIOLOGY

AKI is common in patients with decompensated cirrhosis and ascites, with a prevalence in hospitalized patients that ranges between 27% and 53%.[215] The development of AKI entails a poor prognosis in patients with cirrhosis, with 30-day mortality ranging from 29% to 44%.[216,217] Moreover, AKI is an independent negative predictor of transplant-free survival and post-LT outcomes.[15,215,218-220] HRS is a type of AKI, known as HRS-AKI under the current terminology, unique to patients with cirrhosis that occurs in the absence of hypovolemia or significant abnormalities in kidney histology.[215,218,219] In contrast to AKI, the chronic impairment in kidney function, known as CKD, is defined as a reduction in estimated glomerular filtration rate <60 mL/1.73 m^2 per minute for at least 3 months.[15,221]

DIAGNOSIS, CLASSIFICATION, AND ETIOLOGICAL FACTORS

AKI is diagnosed by an increase in serum creatinine ≥0.3 mg/dL within 48 hours or ≥50% increase in serum creatinine that is known or presumed to have occurred within the preceding 7 days.[15] By convention, stable creatinine values within the previous 3 months before hospitalization can be used as the baseline in the diagnosis of AKI.[15,66] If a previous creatinine before admission is not available, a formal diagnosis of AKI can only be made if creatinine continues to rise during hospitalization. AKI can be staged according to the criteria listed in Table 10.[66,222]

Main etiologies for AKI in cirrhosis are prerenal AKI and acute tubular necrosis (ATN).[15,215,218-220,222] The two main causes of prerenal AKI are hypovolemia and HRS-AKI. ATN is usually due to septic or hypovolemic shock and, less commonly, nephrotoxic drugs/agents. Bile cast nephropathy in patients with hyperbilirubinemia, glomerulonephritis (e.g., immunoglobulin A in alcohol-associated cirrhosis, membranous or membranoproliferative glomerulonephritis