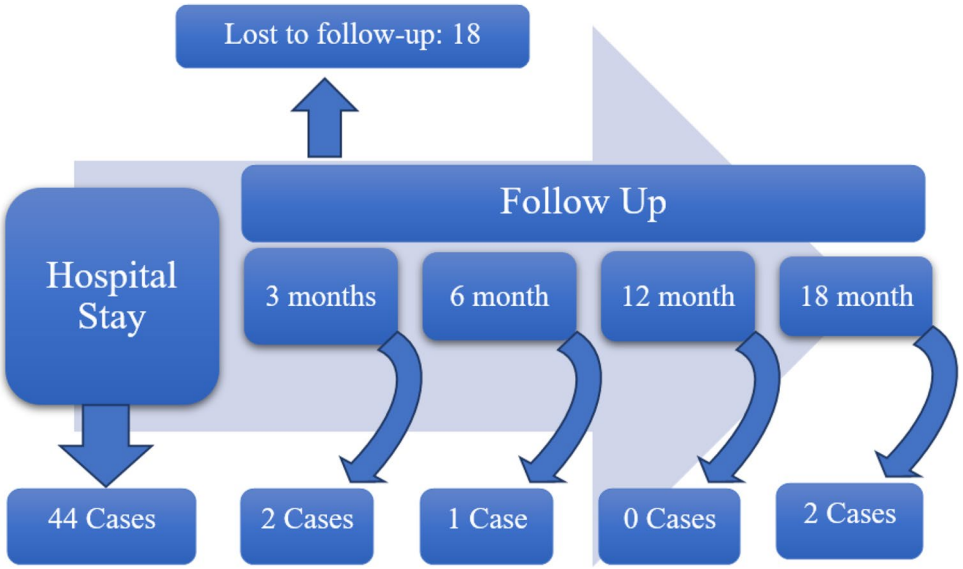

Fig. 2 Mortality of systemic rheumatic diseases admitted to intensive care unit during hospitalization and follow-up

vasopressor drugs, renal replacement therapy, and corticosteroids dose [30, 35]. This data supports the findings from previous reports by Biscotti et al. on mixed cohorts of patients with SRDs [5], in which the mortality rate of SRD patients was 48.4%. Also, Godeau et al. reported ICU mortality rates of 33% [27]. On the contrary, in a large-scale study of 149 critically ill patients with SRD, Faguer et al. found a 28-day mortality rate of 16% [36]. Beil et al. in one study on SRDs patients in ICU in Germany reported mortality rates ranging from 23% in the ICU to 32% in the hospital [37]. One possible explanation of the wide variation of ICU mortality is the difference in patients underlying disease and severity and ICU admission criteria.

Few studies have looked at the prognosis of patients with systemic rheumatic diseases admitted to the ICU in terms of prior medical conditions and treatments. According to Godeau et al. [38], factors linked to in-hospital mortality include severity score, prior health condition, corticosteroid use, and ICU admission for an infectious complication. The main prognostic factors, according to Bouachour et al. [39], were severity score, the number of acute organ system failures, and iatrogenic complications. Poor prior health status, APACHE II score, and admission for infection were identified in Moreels study [13] as prognostic factors for in-hospital mortality; however, prior use of corticosteroids or other immunosuppressive medications was not linked to mortality, in contrast to the data of Godeau et al. [38].

One of the strengths of our study was that, unlike other studies, we included all types of rheumatological diseases. Among the limitations of this study is that the retrospective nature of our study, which accounts for the inability to determine causation, and only association. Also, another limitation was the missing data and incomplete documentation, such as the definite cause of death, disease activity and indices, drug adherence, laboratory data such as platelet to lymphocyte ratio, and pre-admission factors such as unattended comorbidities and clinical reactivation. Another limitation is that we could not differentiate infection based on hospital-acquired or prehospitalization infection. Although our settings were referral centers, the total sample size and frequencies among some variables were relatively low. Therefore, further multicentric studies are recommended. Also, some laboratory tests for diseases such as *Pneumocystis jirovecii* or cytomegalovirus were not routinely available. Also, our study was conducted before the onset of the COVID-19 pandemic and future studies are warranted about changes in the pattern of admission causes.

Conclusion

In summary, in SRD patients, our study demonstrated that both infection and disease exacerbation were the leading reasons for ICU admission. SLE was the most common SRDs admitted to the ICU. Also, the ICU mortality rate was high. Further studies are recommended to improve ICU management and therapeutic regimen evaluations.

Abbreviations APACHE II: Acute physiology and chronic health assessment; CKD: Chronic kidney disease; GPA: Granulomatosis with polyangiitis; ICU: Intensive care unit; IQR: Interquartile range; RA: Rheumatoid arthritis; ROC: Receiver operating characteristic; SD: Standard deviation; SLE: Systemic lupus erythematosus; SRD: Systemic rheumatic diseases; SV: Systemic vasculitis

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Author contribution M. J. F. and S. S. conceived the study; M. A. collected the data; R. S wrote the first draft of the manuscript; S. S. and M. J. F. proofread the manuscript. All authors read and approved the final version before submission.

Data availability All data generated or analyzed during this study are included in this manuscript. Please write to the corresponding author for further information.

Compliance with ethical standards

Ethics approval and consent to participate The ethics committee of Shiraz University of Medical Sciences approved this study (Ethical code: IR.SUMS.MED.REC.1398.522). Patients' information was anonymized before data analysis and confidentiality of patient information was guaranteed and protected.

Consent for publication Not applicable.

Disclosures None.

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