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Atrial fibrillation in allogeneic and autologous hematopoietic stem cell transplant recipients: incidence and clinical implications

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Abstract

Introduction

Atrial fibrillation (AF) is the most common acute cardiovascular complication following hematopoietic cell transplant (HCT). However, the incidence and risk factors for early-onset AF post-HCT remain poorly understood.

Methods

A retrospective cohort study was conducted to assess the onset and risk factors of AF within 90 days post-HCT in 5,965 adult transplant recipients. Patients underwent either allogeneic HCT (alloHCT, n = 2,742) or autologous HCT (autoHCT, n = 3,223) between January 1st, 2010 and December 31st, 2023. Cumulative incidence curves and Gray's tests were used to assess AF cumulative incidence. Fine-Gary proportional sub-distributional hazard models were applied to estimate associations between factors and AF risk.

Results

Among patients without prior arrhythmia, cardiac disease, or valvular heart disease, AF occurred more frequently in alloHCT recipients than in autoHCT recipients (6.3% vs. 4.3%, Gray's test $P < 0.001$). The median age was 54 years (range: 18–82) for alloHCT and 59 years (range: 18–78) for autoHCT. In alloHCT recipients, increased AF risk was associated with older age (≥ 50 vs. <50 years, adjusted hazard ratio (HR) = 2.85, $P < 0.0001$) and lower Karnofsky performance score (KPS, < 80 vs. ≥80, adjusted HR = 1.69, $P = 0.03$). In autoHCT recipients, increased AF risk was associated with older age (adjusted HR = 2.49, $P = 0.006$), lower KPS (adjusted HR = 2.41, $P = 0.0001$) and obesity (adjusted HR = 1.68, $P = 0.015$).

Conclusion(s)

This study indicates that AF cumulative incidence within 90 days post-HCT is higher in alloHCT than in autoHCT patients. Transplant recipients with older age, lower KPS, or obesity have an increased risk for early onset of AF post-HCT.

Introduction

Atrial fibrillation (AF) is one of the most common types of cardiac arrhythmia, affecting approximately 1.5-2% of the general population [1]. It is associated with a significantly increased risk of mortality, primarily due to its link with severe cardiovascular complications, including stroke and decompensated congestive heart failure [2]. In many cases, AF may also serve as a marker of more severe underlying cardiovascular disease.

Compared to the general population, hematopoietic cell transplant (HCT) recipients experience substantially higher cardiovascular mortality, which occurs at more than twice the expected rate, with the

risk continuing to rise over time following transplantation [3]. Among HCT recipients, AF is the most common cardiovascular event observed during the post-transplant period, particularly during the early post-transplant period [4]. This complication frequently occurs during neutropenia and peak inflammatory states, likely due to cytokine release, electrolyte imbalances, and infection-related stress [4].

Currently, both allogeneic (alloHCT) and autologous HCT (autoHCT) are life-prolonging or potentially curative treatment options for patients with various hematologic diseases and malignances. In the United States, approximately 20,000 HCT procedures are performed annually, with numbers continuing to rise [5]. In concordance with an increase in overall procedures being performed, post-procedural survivorship and transplantation rates in elderly patients are also increasing [5]. Because of the evolving HCT landscape, a deeper understanding of the incidence and risk factors for AF in autoHCT and alloHCT recipients may provide valuable insights to enhance post-transplant care and improve patient outcomes.

While the link between increased AF in HCT is documented in literature, previous studies on this topic are limited by a small number of HCT patients (N < 600) and/or focused on only one transplant type [6–13]. A systematic review and meta-analysis showed that the pooled estimated incidence of AF within 30 days following combined alloHCT and autoHCT was 4.2% (95% CI: 1.7%-9.6%) [6]. Although this review summarized risk factors for arrhythmias among HCT recipients, it did not specifically address risk factors for AF, nor did it compare incidence between transplant types.

In prior work, we investigated the incidence and risk factors for AF within five years post-HCT in a relatively small number of alloHCT recipients [14]. In the present study, we utilized a large HCT recipient cohort to describe the onset of AF within 90 days following HCT for both alloHCT and autoHCT recipients. We also examined the associations between AF risk and a broad range of potential risk factors separately for alloHCT and autoHCT patients.

Methods

Study cohort

With approval from the City of Hope (COH) Institutional Review Board, we conducted a retrospective cohort study to assess the onset and risk factors of AF within 90 days after HCT. Eligible HCT recipients were identified through the COH long-term follow-up research protocol (https://www.cityofhope.org/research/hematologic-malignancies-and-stem-cell-transplantation-institute/center-for-survivorship-and-outcomes). This protocol ensures active and comprehensive follow-up of all patients undergoing HCT at COH.

We identified 5,988 adult patients (≥ 18 years) without a prior history of arrhythmia, cardiac disease, or valvular heart disease (including severe aortic stenosis/regurgitation, and severe mitral stenosis/regurgitation) who underwent alloHCT or autoHCT between January 1, 2010, and December 31, 2023. Patients' baseline echocardiogram before transplant showed preserved cardiac systolic function

with left ventricular ejection fraction (LVEF) > 50% and reports of no, trace or mild pericardial effusion. Patients with low LVEF and/or moderate or severe pericardial effusion were not eligible for transplant.

Demographic characteristics and potential risk factors

Data extracted from the COH long-term follow-up protocol included patient demographics (age, sex, and race/ethnicity), comorbidities at transplant (hepatic disease, pulmonary disease, psychiatric disturbance, and obesity with body mass index (BMI) > 30.0), primary diagnosis, Karnofsky performance status scale (KPS) at transplant, conditioning regimen for transplant, type of transplant, and date of death from any cause. For alloHCT recipients, we additionally extracted data regarding donor-recipient gender match, donor type, ABO blood group compatibility, and sirolimus use for graft-versus-host disease (GVHD) prophylaxis.

AF occurrence after transplant

Each patient was followed from the date of HCT until the first AF diagnosis, death, or 90 days post-transplant, whichever occurred first. AF occurrence was identified using the Precision Oncology Software Environment Interoperable Data Ontologies Network (POSEIDON) platform at COH, which is an enterprise-wide informatics platform that integrates patient data from multiple sources to support precision medicine and cancer research. AF within 90 days post-HCT was classified as **Yes/No** based on International Classification of Diseases 10th Edition codes (I48.91, I48.20, I48.19, I48.11, I48.0, I48.3, I48.4). The date of first AF diagnosis was recorded. For a small portion of patients with discrepancies between AF occurrence and the use of amiodarone or sotalol, we performed a detailed medical chart review to resolve inconsistencies.

Statistical Analysis

We excluded 23 patients due to unclear or missing follow up data for AF (n = 19) or vital status (n = 4) after HCT, resulting in a final analytic cohort of 5,965 patients (alloHCT, n = 2,742; autoHCT, n = 3,223).

The characteristics of the cohort were summarized using standard descriptive statistics and presented in contingency tables. To compare AF risk between alloHCT and autoHCT, the cumulative incidence of AF within 90 days post-transplant was estimated using cumulative incidence curves and Gray's test in univariate analysis, treating death as a competing risk. In multivariable analysis, we used Fine–Gray proportional sub distribution hazard models to assess differences in AF risk between alloHCT and autoHCT, adjusting for age, BMI, and KPS, which were identified as factors associated with AF risk in the preceding analyses.

Fine–Gray models were also applied to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for associations of AF with potential risk factors within each transplant type. Significance of HRs was assessed using the Wald test. Factors examined in univariate analyses included demographics (age,

gender, race/ethnicity), comorbidities (comorbidity index, diabetes, hepatic disease, pulmonary disease, psychiatric disturbance, obesity), primary diagnosis, KPS at transplant, and conditioning regimen. For alloHCT patients, donor-recipient gender match, donor type, ABO compatibility, and GVHD prophylaxis medications were additionally considered.

Variables with $P < 0.05$ in univariate analysis were initially included in multivariable models. Forward selection was applied to re-evaluate variables with $P \geq 0.05$, but none were retained. Final multivariable models included only variables with univariate $P < 0.05$.

All statistical analyses were two-sided, and a $P < 0.05$ was considered statistically significant. Data was analyzed using SAS Version 9.4 software (SAS Institute, Cary, NC).

Results

Patient Characteristics

Table 1 shows the characteristics of the cohort. Of the 5,965 HCT patients, 2,742 underwent alloHCT, and 3,223 underwent autoHCT. The median age at transplant was 54 years (range: 18–82) for alloHCT and 59 years (range: 18–78) for autoHCT patients. The majority of patients were male (alloHCT: 53.5%, autoHCT: 56.2%) and White (alloHCT: 75.6%, autoHCT:70%). The most common primary diagnosis was acute myeloid leukemia (40.5%) in alloHCT patients and multiple myeloma (59%) in autoHCT patients. Approximately 80% of patients had at least one comorbidity at transplant (alloHCT: 81.8%, autoHCT: 79.9%). About 7% of patients had a KPS lower than 80 at transplant (alloHCT: 6.7%, autoHCT: 7.4%). Ablative conditional regimen was used in 41.8% of alloHCT patients and 97.5% of autoHCT patients. More than 50% alloHCT donors were gender-matched (54.2%), matched-unrelated (51.4%), and ABO compatible (58.4%). For GVHD prophylaxis, all alloHCT patients received tacrolimus, 67.7% received sirolimus, and 9.8% received methotrexate.

AF cumulative incidence within 90 days after alloHCT or autoHCT

Among the 2,742 alloHCT patients, 174 AF events were identified during first 90 days after alloHCT with 50% occurring within 26 days. Among the 3,223 autoHCT patients, 139 AF events were identified during first 90 days after autoHCT with 50% of occurring within 10 days. The risk of AF in alloHCT patients continued to increase throughout the 90-day follow-up period, whereas the risk in autoHCT patients plateaued after approximately 30 days (Fig. 1). The cumulative incidence of AF within 90 days after HCT was significantly higher in alloHCT versus autoHCT patients (6.3% vs. 4.3%, Gray test $P < 0.001$).

The difference in the risk of AF within 90 days after HCT between alloHCT and autoHCT still existed after controlling for age, BMI, and KPS (alloHCT vs. autoHCT: HR = 1.74, 95% CI = 1.39–2.19, $P < 0.0001$, from Fine-Gary proportional sub-distributional hazard model adjusting for age, BMI and KPS, data not shown in table).

Risk of AF within 90 days after alloHCT

Table 2 presents the associations between factors of interest and risk of AF within 90 days after alloHCT. In univariate analysis, increased risk of AF within 90 days after alloHCT was associated with six factors, including older age at transplant (≥50 vs. <50 years, *P*<0.0001), diabetes (*P*=0.027), lower KPS at transplant (<80 vs. ≥80, *P*=0.008), non-myeloablative/reduced intensity (vs. ablative, *P*<0.0001), stem cells from matched-unrelated-donors/mismatched unrelated donors (vs. matched-related-donor, *P*=0.017), and sirolimus use for GVHD prophylaxis (*P*=0.018). In multivariable analysis, the association with older age at transplant and lower KPS at transplant remained. Patients aged 50 years or older at alloHCT exhibited a 2.85-fold increased risk for AF than those under 50 years old at alloHCT (adjusted HR=2.85, 95%=1.90-4.29, *P*<0.0001). KPS less than 80 was associated with a 1.69-fold increased risk of AF compared to a KPS at least 80 (adjusted HR=1.69, 95% CI=1.05-2.71, *P*=0.03).

Risk of AF within 90 days after autoHCT

Table 3 presents the associations between factors of interest and risk of AF within 90 days after autoHCT. In univariate analysis, the increased risk of AF within 90 days after autoHCT was associated with three factors, including older age at transplant (≥50 vs. <50 years, *P*=0.0009), lower KPS at transplant (<80 vs. ≥80, *P*<0.0001), and obesity (*P*=0.048). In multivariable analysis, the associations observed in univariate analysis remained. Patients aged 50 years or older at autoHCT exhibited a 2.49-fold increased risk for AF than those under 50 years old at autoHCT (adjusted HR=2.49, 95%=1.48-4.17, *P*=0.006). KPS less than 80 was associated with a 2.41-fold increased risk of AF compared to KPS of at least 80 (adjusted HR=2.41, 95% CI=1.54-3.79, *P*=0.0001). Patients with obesity exhibited 68% higher risk of AF than those without obesity (adjusted HR=1.68, 95% CI=1.11-2.54, *P*=0.015).

Discussion

In this large cohort of patients without a prior history of arrhythmia, cardiac disease, or valvular disease who underwent alloHCT or autoHCT, we found that the 90-day cumulative incidence of AF was statistically higher in alloHCT recipients compared to those who underwent autoHCT. Among alloHCT patients, older age and lower KPS were associated with an increased risk of early-onset AF. In autoHCT recipients, older age, lower KPS, and obesity were associated with a higher risk of early-onset AF following transplantation.

The temporal divergence in AF incidence patterns between alloHCT and autoHCT is also noteworthy. We observed that AF risk in alloHCT patients continued to rise throughout 90-day follow-up, whereas autoHCT demonstrated a plateau after approximately 30 days. This difference likely reflects fundamental differences in transplant-related stressors. AlloHCT recipients experience dose-dense chemotherapy (including melphalan), prolonged systemic inflammation, immunosuppressive therapy, and complications such as GVHD—all of which may perpetuate arrhythmogenic stress beyond initial hospitalization. In contrast, autoHCT patients typically encounter shorter peri-transplant stressors—such

as electrolyte imbalances—resulting in early clustering of AF events with limited late occurrence [15,16]. Previous studies indicate that this divergence persists beyond the acute post-transplant phase, with alloHCT patients experiencing a higher incidence of long-term cardiovascular events compared to autoHCT recipients [17]. These findings indicate that clinical management of patients, particularly in the early post-transplant days, may differ between patients based on transplant type.

The rate of AF occurrence found in our present study is similar to previously reported incidence, with most studies reporting incidence of AF between 2–6% in the first 100 days post-transplant. While the risk of AF in HCT patients is documented, significant differences in AF incidence, timing, and risk factors following alloHCT and autoHCT have not previously been reported. Prior studies were limited by analysis on one transplant type, low or unequal sample size, or rate of AF incidence in the acute phase post-transplantation. Our study offers a fine-tuned examination of AF incidence within both autoHCT and alloHCT which further delineates the demographic and mechanistic drivers of AF development within these different patient populations.

Mechanistically, AF development is multifactorial, involving structural and electrical atrial remodeling. Chronic atrial stretch, systemic inflammation, and oxidative stress contribute to fibroblast proliferation and extracellular matrix deposition, creating a substrate for arrhythmogenesis. Aging amplifies these processes through atrial fibrosis and gradual deterioration of immune system, while comorbidities such as obesity, diabetes, and hypertension exacerbate oxidative stress and autonomic imbalance [18–20]. Obesity, identified as independent risk factor in our autoHCT cohort, is increasingly recognized as a state of sympathetic overactivity and parasympathetic withdrawal, which promotes hypertension and cardiac remodeling, indirectly increasing AF risk. Observational studies demonstrate that elevated BMI independently predicts AF incidence in a non-HCT populations as well [21–23]. With the rise of glucagon-like peptide-1 receptor agonists being used to treat obesity and comorbidities, obesity is becoming an increasingly modifiable risk factor.

Our findings align with prior literature emphasizing older age and poor baseline health, including limited functional capacity, as dominant risk factors for AF in both general and transplant populations [16]. The association between lower KPS and AF risk likely reflects frailty and comorbidity burden, which amplify the proarrhythmic substrate created by transplant-related stressors. As the number of transplants in older patients is increasing, our findings indicate that post-HCT AF incidence may rise as well [5].

The use of HCT as a life-prolonging treatment strategy for many hematologic conditions and malignancies is increasing along with survival rates. With increased survival, there is a greater emphasis on comorbidities and post-transplant long-term health. AF following HCT is associated with increased risk of cardiovascular complications, mortality, hospitalization, and care cost [24]. Our study identifies overall incidence and risk factors of AF in autoHCT and alloHCT patients—highlighting the importance of comprehensive pre-transplant cardiovascular risk assessment and tailored monitoring and preventative strategies for vulnerable patients.

Despite these valuable insights, this study has several limitations. First, it is a retrospective analysis, meaning the findings are based on historical data and may be subject to biases such as incomplete medical records or inconsistent documentation [14,25]. Another limitation is the potential underreporting of AF events, particularly among patients with infrequent outpatient follow-up after hospital discharge. This may result in misclassification or missed detection of late-onset or asymptomatic AF episodes, potentially underestimating the true incidence.

Conclusion

In conclusion, AF is a relatively common yet under-recognized complication in HCT recipients. Our study highlights that AF is more prevalent in alloHCT versus autoHCT, and that older age, lower KPS, and obesity also increase AF risk [14,25,26]. These findings support earlier literature while also providing insights into transplant type and early-onset AF in HCT patients [27,28]. By identifying high-risk patients, clinicians can consider closer monitoring and early interventions to reduce morbidity associated with post-transplant AF [15,16].

Abbreviations

AF
Atrial fibrillation
AlloHCT
Allogeneic hematopoietic cell transplant
AutoHCT
Autologous hematopoietic cell transplant
BMI
Body mass index
CI
Confidence interval
COH
City of Hope
GVHD
Graft-versus-host disease
HCT
Hematopoietic cell transplant
HR
Hazard ratio
KPS
Karnofsky performance status
LVEF
Left ventricular ejection fraction

POSEIDON
Precision Oncology Software Environment Interoperable Data Ontologies Network

Declarations

The authors declare that they have no competing interests.

Human Ethics and Consent to Participate Declarations:

This retrospective cohort study was reviewed and approved by the City of Hope (COH) Institutional Review Board (IRB No. 25419). The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). A waiver of informed consent was granted by the Institutional Review Board due to the retrospective nature of the study.

Consent for Publication:

Not applicable.

Availability of Data and Materials:

The datasets generated and/or analyzed during the current study are not publicly available due to institutional policies and patient privacy requirements but are available from the corresponding author on reasonable request and with appropriate regulatory approvals.

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Author's Contributions:

LC and HM conceived and designed the study. LC and RT provided financial support, and RT provided administrative support. KC collected and assembled the data. HM performed the data analysis and interpretation. All authors contributed to manuscript preparation and revision, approved the final version of the manuscript, and agree to be accountable for all aspects of the work.

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References

1. Camm AJ, Lip GY, De Caterina R, et al. 2012 focused update of the ESC Guidelines for the management of atrial fibrillation: an update of the 2010 ESC Guidelines for the management of atrial fibrillation. Developed with the special contribution of the European Heart Rhythm Association. Eur Heart J Nov. 2012;33(21):2719–47. 10.1093/eurheartj/ehs253.
2. Bordignon S, Chiara Corti M, Bilato C. Atrial Fibrillation Associated with Heart Failure, Stroke and Mortality. J Atr Fibrillation Jun-Jul. 2012;5(1):467. 10.4022/jafib.467.
3. Chow EJ, Mueller BA, Baker KS, et al. Cardiovascular hospitalizations and mortality among recipients of hematopoietic stem cell transplantation. Ann Intern Med Jul. 2011;5(1):21–32. 10.7326/0003-4819-155-1-201107050-00004.
4. Hayek SS, Zaha VG, Bogle C, et al. Cardiovascular Management of Patients Undergoing Hematopoietic Stem Cell Transplantation: From Pretransplantation to Survivorship: A Scientific Statement From the American Heart Association. Circulation Apr. 2024;16(16):e1113–27. 10.1161/CIR.0000000000001220.
5. Phelan R, Chen M, Bupp C, et al. Updated Trends in Hematopoietic Cell Transplantation in the United States with an Additional Focus on Adolescent and Young Adult Transplantation Activity and Outcomes. Transplant Cell Ther Jul. 2022;28(7):e4091–40910. 10.1016/j.jtct.2022.04.012.
6. Chiengthong K, Lertjitbanjong P, Thongprayoon C, et al. Arrhythmias in hematopoietic stem cell transplantation: A systematic review and meta-analysis. Eur J Haematol Dec. 2019;103(6):564–72. 10.1111/ejh.13322.
7. Fatema K, Gertz MA, Barnes ME, et al. Acute weight gain and diastolic dysfunction as a potent risk complex for post stem cell transplant atrial fibrillation. Am J Hematol Aug. 2009;84(8):499–503. 10.1002/ajh.21459.
8. Knaggs Mea. Risk Model to Predict Supraventricular Arrhythmias in Multiple Myeloma Patients Undergoing Autologous Stem Cell Transplant. ASTCT. 2019;25(3):S156–7.
9. Sureddi RK, Amani F, Hebbar P, et al. Atrial fibrillation following autologous stem cell transplantation in patients with multiple myeloma: incidence and risk factors. Ther Adv Cardiovasc Dis Dec. 2012;6(6):229–36. 10.1177/1753944712464102.
10. Steuter JA, Villanueva ML, Loberiza FR, et al. Factors affecting the development of atrial fibrillation and atrial flutter (AF/AFL) following autologous hematopoietic SCT (auto-HSCT). Bone Marrow Transplant Jul. 2013;48(7):963–5. 10.1038/bmt.2012.253.
11. Gertz MA. Relationship of Stem Cell Transplant and Risk of Atrial Fibrillation in Multiple Myeloma: A Case-Control Study. Sci Direct. 2007;110(11):3001.
12. Peres E, Levine JE, Khaled YA, et al. Cardiac complications in patients undergoing a reduced-intensity conditioning hematopoietic stem cell transplantation. Bone Marrow Transplant Jan. 2010;45(1):149–52. 10.1038/bmt.2009.97.
13. Motoki N, Shimizu T, Akazawa Y, et al. Increased pretransplant QT dispersion as a risk factor for the development of cardiac complications during and after preparative conditioning for pediatric

allogeneic hematopoietic stem cell transplantation. Pediatr Transplant Dec. 2010;14(8):986–92. 10.1111/j.1399-3046.2010.01389.x.

14. Chang EK, Chanson D, Teh JB, et al. Atrial Fibrillation in Patients Undergoing Allogeneic Hematopoietic Cell Transplantation. J Clin Oncol Mar. 2021;10(8):902–10. 10.1200/JCO.20.02401.
15. Na J, Garapati SS, Lador A. Obesity and Atrial Fibrillation: A Comprehensive Review. Methodist Debakey Cardiovasc J. 2025;21(2):35–43. 10.14797/mdcvj.1516.
16. Zhao S, Johnston AM, Yiu CHK, Moreira LM, Reilly S, Wehrens XHT. Aging-associated mechanisms of atrial fibrillation progression and their therapeutic potential. J Cardiovasc Aging Dec. 2024;4(4). 10.20517/jca.2024.12.
17. Vasbinder AHC, Catalan T, Anderson E, Chu C, Kotzin M, Xie J, Kaakati R, Berlin HP, Shadid H, Perry D, Pan M, Takiar R, Padalia K, Mills J, Meloche C, Bardwell A, Rochlen M, Blakely P, Leja M, Banerjee M, Riwes M, Magenau J, Anand S, Ghosh M, Pawarode A, Yanik G, Nathan S, Maciejewski J, Okwuosa T, Hayek SS. Cardiovascular Events After Hematopoietic Stem Cell Transplant: Incidence and Risk Factors. JACC CardioOncol. 2023. 10.1016/j.jaccao.2023.07.007.
18. Andrade J, Khairy P, Dobrev D, Nattel S. The clinical profile and pathophysiology of atrial fibrillation: relationships among clinical features, epidemiology, and mechanisms. Circ Res Apr. 2014;25(9):1453–68. 10.1161/CIRCRESAHA.114.303211.
19. Youn JY, Zhang J, Zhang Y, et al. Oxidative stress in atrial fibrillation: an emerging role of NADPH oxidase. J Mol Cell Cardiol Sep. 2013;62:72–9. 10.1016/j.yjmcc.2013.04.019.
20. Sha R, Baines O, Hayes A, et al. Impact of Obesity on Atrial Fibrillation Pathogenesis and Treatment Options. J Am Heart Assoc. Jan 2024;2(1):e032277. 10.1161/JAHA.123.032277.
21. Shu H, Cheng J, Li N, et al. Obesity and atrial fibrillation: a narrative review from arrhythmogenic mechanisms to clinical significance. Cardiovasc Diabetol Jul. 2023;29(1):192. 10.1186/s12933-023-01913-5.
22. Grassi G, Drager LF. Sympathetic overactivity, hypertension and cardiovascular disease: state of the art. Curr Med Res Opin. 2024;40(sup1):5–13. 10.1080/03007995.2024.2305248.
23. Lambert EA, Esler MD, Schlaich MP, Dixon J, Eikelis N, Lambert GW. Obesity-Associated Organ Damage and Sympathetic Nervous Activity. Hypertension Jun. 2019;73(6):1150–9. 10.1161/HYPERTENSIONAHA.118.11676.
24. Zaghlol RDE, Manian N, Altibi A, Mitchell JD. Atrial fibrillation or flutter in patients undergoing stem cell transplantation, in-hospital and post-discharge outcomes in a large nationwide sample across the United States. Cardiooncology. 2025. 10.1186/s40959-025-00346-1.
25. Chow EJ, Wong K, Lee SJ, et al. Late cardiovascular complications after hematopoietic cell transplantation. Biol Blood Marrow Transplant Jun. 2014;20(6):794–800. 10.1016/j.bbmt.2014.02.012.
26. Krishan S, Asad ZUA, Quiroga D, et al. Comparison of atrial fibrillation prevalence and in-hospital cardiovascular outcomes between patients undergoing allogeneic versus autologous hematopoietic

stem cell transplantation: insights from the national inpatient sample. Sci Rep Jul. 2024;22(1):16829. 10.1038/s41598-024-65294-9.

27. Hindricks G, Potpara T, Dagres N, et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS): The Task Force for the diagnosis and management of atrial fibrillation of the European Society of Cardiology (ESC) Developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC. Eur Heart J Feb. 2021;1(5):373–498. 10.1093/eurheartj/ehaa612.
28. Dublin S, French B, Glazer NL, et al. Risk of new-onset atrial fibrillation in relation to body mass index. Arch Intern Med Nov. 2006;27(21):2322–8. 10.1001/archinte.166.21.2322.

Tables

Tables 1 to 3 are available in the Supplementary Files section.

Figures

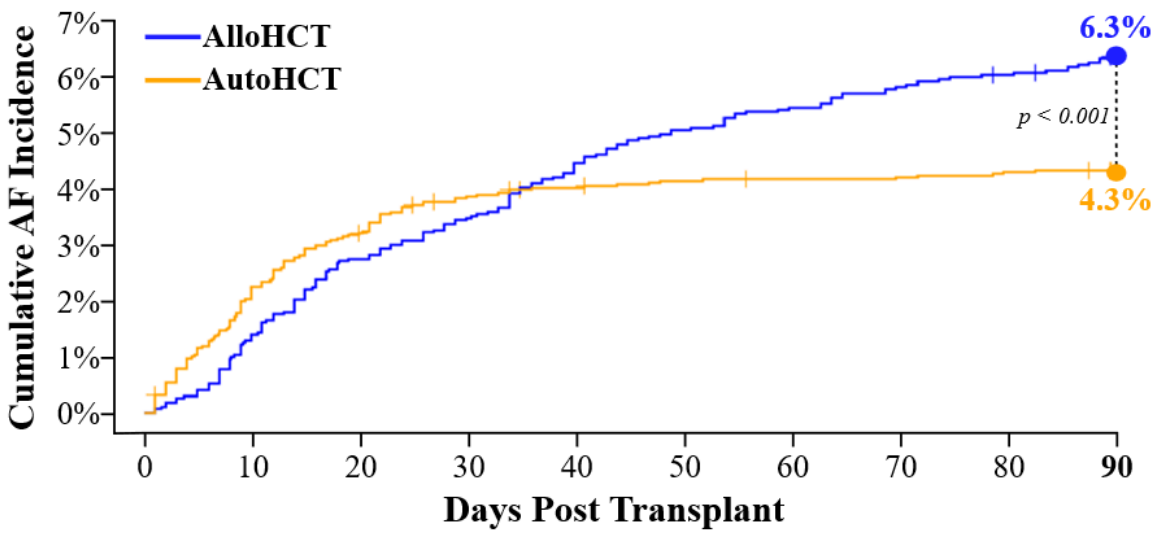


Figure 1

Cumulative Atrial Fibrillation Incidence Within 90 Days[CC1] [CC2] .

The cumulative AF incidences within 90 days after alloHCT and autoHCT were assessed using cumulative incidence curves and Gray test, where death was considered as a competing risk for AF.

Abbreviations: AF, Atrial fibrillation; AlloHCT, Allogeneic hematopoietic cell transplant; AutoHCT, Autologous hematopoietic cell transplant

Supplementary Files

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