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Comparison between same-day discharge and overnight stay after atrial fibrillation ablation: Systematic review and meta-analysis

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Abstract

Background: In the modern era, atrial fibrillation (AF) ablation trend has been shifted toward same-day discharge (SDD), from a traditional overnight stay. Yet, recent studies have not well stated the safety profiles which remained poor-understood and dispersed. We hence performed systematic review and meta-analysis to assess the adverse outcomes of SDD in comparison with an overnight stay.

Methods: Databases were searched through January 2021. Effect estimates from the individual studies were extracted and combined using random-effects, generic inverse variance method of der Simonian and Laird. The primary outcomes included total cumulative complications and immediate complications following AF ablation.

Results: Ten observational studies were met our inclusion criteria, comprising of total population of 11,660 patients, with SDD 51.3%. For total cumulative complications, there were no differences observed between SDD and overnight stay (5.2% vs. 6.2%: pooled OR 0.77: 95% CI 0.55–1.08, $p = .13$ with $I^2 = 27.1\%$). In addition, comparable immediate complications were also demonstrated (5.2 % vs. 4.3: pooled OR 1.08: 95% CI 0.72–1.62, $p = .718$, with $I^2 = 37.3\%$).

Conclusion: Our study suggested that SDD had similar complication rates, both total cumulative and immediate outcomes, compared with overnight stay in selected patients following AF ablation. Nevertheless, randomized control trials are warranted to validate the findings.

KEYWORDS
atrial fibrillation ablation, overnight stay, same day discharge

Abbreviation: AF, atrial fibrillation; COVID-19, coronavirus disease2019; GA, general anesthesia; ICE, intracardiac echocardiogram; RCT, randomized control trial; RFA, radiofrequency ablation; SDD, same-day discharge; TEE, transesophageal echocardiogram; TIA, transient ischemic attack; UK, United Kingdom.

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1 | INTRODUCTION

In the past decades, a trend toward AF ablation has been significantly rising, reflecting a higher fidelity in this technology.[1] Despite the promising clinical advantageous demonstrated by previous studies,[2–4] higher rates of hospitalization for the procedure have been observed, accompanied by a significant increment in medical cost for hospital stay up to 60%.[5] As an estimated AF prevalence and incidence across all age groups are projected toward 60% worldwide in 2050,[6] the needs of AF treatment, including AF ablation, are subjected to proportionally increasing.

Recently, same-day discharge (SDD) protocol is recommended for elective percutaneous coronary intervention (PCI) if certain criteria are met.[7] This is in response to the emerging of COVID-19, which requires extensive resources and healthcare utilization.[8] With current greater understanding and experience in AF ablation, an outpatient setting for the catheter ablation sounds conducive, feasibly resorting and allaying the impacts of this world great pandemic. Previous studies have suggested potential merits of using SDD protocol, providing medical efficiency while reducing medical expenses.[9,10] Nevertheless, there remains uncertainty in employing this strategy given the lack of standardized protocol and limited data on clinical outcomes.

We hence conducted this comprehensive systematic review and meta-analysis of all relevant data to determine the safety profiles between SDD and overnight stay following AF ablation.

2 | METHODS

2.1 | Protocol registration

This study was compiled with MOOSE[11] (Meta-analysis of Observational Studies in Epidemiology) statement as described in online supplementary data. The protocol was also registered with PROSPERO (International Prospective Register of Systematic Reviews; -CRD42021231537). Institutional review board approval was not sought because of the use of publicly available cumulative published data.

2.2 | Literature review and search strategy

A systematic literature search of MEDLINE, EMBASE, and the Cochrane Database of Systematic Reviews was conducted, retrieving databases from inception to January 2021. Search terms were included "same day discharge", "day care", "day case", "short stay", "catheter ablation" and "atrial fibrillation", provided in online supplementary data 1.

2.3 | Study selection

Citations were stored, and duplicates were removed using the EndNote software (Thomson Reuters, Toronto, Ontario, Canada). Two independent reviewers (Narut Prasitlumkum and Ronpichai Chokesuwattanaskul) screened the abstracts and titles of the studies and subsequently reviewed the full-text articles for inclusion on the Rayyan ([http://rayyan.qcri.org] a free web-based and mobile articles screening tool which was designed to screen titles/abstracts for the relevant search terms through academic search engines).[12] No language restriction was limited. A manual search for conceivably relevant studies using references of the included articles was also performed. Authors of the included trials were contacted to clarify unclear information, if necessary. When there were disagreements between the reviewers, we have discussed until we reach a consensus. Newcastle-Ottawa quality assessment scale (NOS) was used to appraise the quality of study for case-control study and outcome of interest for cohort study, as shown in supplementary 3.[13]

2.4 | Inclusion criteria

1. Study type: Cross-sectional, case-control, cohort studies, or RCT
2. Patient population: Adults > 18 years old undergoing AF ablation
3. Intervention: Discharge on the same day after AF ablation
4. Control: Overnight stay after AF ablation and discharge based on clinician's discretion
5. Outcomes: Total complications

2.5 | Data extraction and outcome

Comprehensive data extraction was performed to derive the following information from each study, including title, year of the study, name of the first author, publication year, country where the study was conducted, demographic and characteristic data of subjects, total numbers of participants in each study and discharge protocol (SDD, overnight stay) and total complications. For the most accurate analysis, we utilized OR/RR/HR from multivariable adjustment from studies that contain content of the available data. Otherwise, we extracted absolute numbers provided in each cohort and proceeded with univariate analysis.

First primary outcome: Total complications. It was defined by a summation of any cardiac and noncardiac procedural-related events till the end of follow-up, in which each study was defined, ranging from 30 to 180 days after patients were discharged.

Second primary outcome: Immediate complications. It was defined by a summation of any cardiac and noncardiac procedural-related events within 48 h.

Secondary outcome: Total bleeding events, total pericardial conditions, total stroke/TIA, and total phrenic nerve injury.

Exploratory outcomes: In a *post hoc* manner, our decision was made to investigate which factors were associated with successful SDD. Factors included in this study were retrieved directly from reported studies. Not limited to this notice, other potential factors were considered in line with authors' agreement after reviewing inherent studies which described predictors of complications following AF ablation.[14–18] This

consensus was constituted based on the assumption that postprocedural complications prevent successful early discharge.

2.6 | Outcome ascertainment

For immediate complications detection, routine postprocedural surveillance was performed according to each study's protocol. Routine postprocedural physical exam was performed by medical providers. All readmission and ER visits medical records were reviewed.

For other complications detection, patients were routinely followed up at the clinics of participating centers in each study. Routine physical exam was performed by medical providers and all relevant medical records, including outpatient follow-up, ER visits, and hospital readmission after the procedure within follow-up periods according to each study.

2.7 | Statistical analysis

Random-effects model was used to perform meta-analysis given anticipated between-study heterogeneity. Standardized mean differences (SMDs) were used to estimate effect sizes for continuous data. To dichotomize continuous data, if necessary, Hasselblad and Hedges' method was used for conversion, assuming near-normal logistic distribution and equal variance.[19,20] For dichotomous data, generic inverse variance method of der Simonian and Laird[21] was used to estimate odds ratios (ORs) and 95% CIs. The heterogeneity of effect size estimates across studies was quantified using the Mantel-Haenszel chi-square test and I^2 statistics. Substantial heterogeneity was predefined as $p < .10$ for Mantel-Haenszel chi-square test. The I^2 statistic ranges in value from 0% to 100% ($I^2 < 25\%$, low heterogeneity; $I^2 = 25\%$ to 50%, moderate heterogeneity; and $I^2 > 50\%$, substantial heterogeneity).[13]

In accordance with Cochrane, publication bias was assessed by evaluation of the symmetry of a funnel plot. Egger's linear regression test and Begg's rank correlation test were used for objective evaluation, of which the presence of publication bias is defined by $p < .05$. All analysis was performed using STATA version 16 (College Station, TX, USA: StataCorp LLC).

3 | RESULTS

A total of 475 potentially eligible articles were identified through Rayyan[12] using our search strategy. One hundred and fifteen articles were excluded due to duplicated studies. After the exclusion of 217 articles as the inclusion criteria were not fulfilled, there were 28 articles left for full-length review. Fifteen were excluded as no SDD protocol was implemented. One was excluded because patients undergoing AF ablation were excluded. One was excluded as it was only an editorial comment. Lastly, one study was excluded substantial patients who lost follow-up during the study timeframe. Thus, the final analysis included 10 observational studies (seven retrospective cohort studies, three prospective cohort studies).[22–31] The literature retrieval, review, and selection process are demonstrated in Figure 1. The characteristics and quality assessment of the included studies are presented in Table 1. Selection criteria and definitions of complications from each study were summarized in Table 2.

3.1 | Study characteristics and quality assessment

Total populations included in our study were 11,660 (51.3% under SDD protocol and 48.7 under overnight stay). 60.5% of included studies' populations were female, with an average age of 61.7 ± 9.7 years old. Mean follow-up time was 54 days (range 30—180 days). The proportion of echocardiography-guided catheter ablation usage (ICE/TEE) was extensively varied, from 0% to 100%. Postprocedural echocardiography was routinely employed in the majority of included studies[22,23,27–29] except Akula et al.[30] as ICE was already used periprocedurally. For Bartoletti et al., Reddy et al., and Deyell et al.,[24–26] echocardiogram was performed only if clinically indicated. It was not clearly specified in Ignacio et al. whether routine echocardiogram was used.

In SDD group, only 2.5% (148/5981) was not discharged on the same day as planned. Up to 42.5% (63/148), the reason for prolonging admission was inherently due to procedural-related complications. On the other hand, the rest was not relevant to the procedure, including patient's preference, late procedures, and patient's non-procedural medical problems.

Majority of anticoagulation methods were uninterrupted plans. RFA was the main ablation type commonly used (58.8%) in our meta-analysis. Overall mortality rates in this cohort are extremely low (< 0.01%) in both SDD and overnight stay. NOS has ranged from 6 to 8, indicating moderate to high qualities of included studies.

3.2 | Primary outcome

For total cumulative complications rates, there was no difference between SDD (5.2%) and overnight stay (6.2%) (pooled OR 0.77: 95% CI 0.55–1.08, $p = .13$). There was moderate heterogeneity in this analysis ($I^2 = 27.1\%$). Similarly, no statistical differences in immediate complications were observed in both protocols (5.2 % in SDD vs. 4.3 % in overnight stay; pooled OR 1.08: 95% CI 0.72–1.62, $p = .718$, with moderate heterogeneity ($I^2 = 37.3\%$) (Figure 2).

3.3 | Secondary outcome

Common complications including total bleeding events, total pericardial complications, total stroke/TIA and total phrenic nerve injuries were individually sought. No differences were found between SDD and overnight stay in total bleeding (1.4 % vs. 2.6 %; pooled OR 1.25: 95% CI 0.62–2.51, $p = .528$), stroke/TIA (0.24 % vs. 0.17 %; pooled OR 1.25:

TABLE 1 Study characteristics of included studies

Study (year)	Study type	Country	Total numbers of centers	Total population		Mean age (Years old)	Male (%)	Follow up duration (days)	Anticoagulation strategy
Akula 2020	Retrospective cohort	USA	Single	ON	145	60.2	60	90 days	Operators' preferences
				SDD	426	62.3	52		
Bartoletti 2019	Retrospective cohort	UK	Single	ON	642	59 ± 11	68.5	90 days	Uninterrupted warfarin and minimally interrupted DOACs
				SDD	143	59 ± 11	68.1		
Creta 2020	Retrospective cohort	UK	Multicenter	ON	1901	62.9 ± 11.3	60.1	30 days	Uninterrupted anticoagulation
				SDD	727	61.1 ± 12.5	68.2		
Deyell 2020	Retrospective cohort	Canada	Multicenter	All	3054	60.4 ±9.5	73.8	30 days	Mixed (majority is interrupted plan)
He 2020	Retrospective cohort	UK	Multicenter	ON	553	59.7± 12.1	43	120 days	Uninterrupted anticoagulation
				SDD	414	62.5± 10.8	45		
Kowalski 2020	Retrospective cohort	USA	Multicenter	ON	1180	66 ± 10	67	30 days	Operators' preferences
				SDD	1194	64 ± 11	69		
Mondrago 2018	Prospective cohort	Argentina	Single	ON	137	57.3 ± 12.9	75.2	30 days	Interrupted anticoagulation
				SDD	58	59.9 ± 10.5	84.5		
Opel 2019	Prospective cohort	UK	Multicenter	ON	276	60 ± 0.8	60	90 days	Uninterrupted anticoagulation
				SDD	276	61 ± 0.7	61		
Rajendra 2020	Prospective cohort	USA	Single	ON	41	59.9 ± 12.8	61	90 days	Uninterrupted anticoagulation
				SDD	41	58.5 ± 9.9	61		
Reddy 2020	Retrospective cohort	UK	Single	ON	168	60.36±10.0	72.9	180 days	Uninterrupted warfarin and minimally interrupted DOACs

(Continues)

TABLE 1 (Continued)

Study (year)	Study type	Country	Total numbers of centers	Total population		Mean age (Years old)	Male (%)	Follow up duration (days)	Anticoagulation strategy		
				SDD	284	60.16±9.9	70.8				
Study (year)	General anesthesia (%)	Use of ICE/TEE guidance	Ablation strategy		Procedural time (min)	Prior AF ablation (%)	BMI	Comorbidities			
			RFA (%)	Cryo (%)				Hypertension (%)	DM2 (%)	Cardiomyopathy (%)	prior Stroke/TIA (%)
Akula 2020	n/a	100 % (ICE)	100	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
					n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bartoletti 2019	46.2	Not mentioned	67.6	32.4	153 ± 43	20.6	29.5 ± 5.2	n/a	n/a	n/a	n/a
	62.5		61.5	38.5	120 ± 29	40.6	29.4 ± 5.0	n/a	n/a	n/a	n/a
Creta 2020	8.4	30.6 % (Only ICE, no TEE use in this study)	62.6	37.4	150 ± 83	40.4	n/a	n/a	n/a	15.50	n/a
	34.8		20.8	79.2	79 ± 42	13.8	n/a	n/a	n/a	10.90	n/a
Deyell 2020	98.7	53.5% (TEE)0.3 % (ICE)	96.5	3.5	190±69.7	n/a	n/a	39.9	8	13.2	7.8
He 2020	6	Not mentioned	92.1	6.9	169.2± 71.8	15	n/a	n/a	n/a	2	n/a
	2		21.3	78.7	146.2± 80.9	7.7	n/a	n/a	n/a	5	n/a
Kowalski 2020	100	100 %(ICE)	0	100	n/a	n/a	31 ± 6	72	21	16	6
							30 ± 6	72	18	10	5

(Continues)

TABLE 1 (Continued)

			RFA (%)	Cryo (%)				Hypertension (%)	DM2 (%)	Cardiomyopathy (%)	prior Stroke/TIA (%)
Mondrago 2018	100	Not mentioned	n/a	n/a	n/a	19.6	27.7 ± 4.5	59	17	n/a	n/a
						20	28.4 ± 3.8	24	6		
Opel 2019	89	0% (No use of either TEE or ICE)	0	100	63.5± 1.1	0	n/a	61	9	n/a	7
					101.7± 2.9	0	n/a	47	7		4
Rajendra 2020	100	Not mentioned	100	0	67 ± 22	4.9	29.7 ± 4.6	56.1	2.4	0	0
					59 ± 15	7.3	30.1 ± 5.2			4.9	4.9
Reddy 2020	60.1	Not mentioned	73.6	22.9	160.76 ± 48.6	28.6	n/a	n/a	n/a	n/a	n/a
	29.2		57.1	42.9	139.66 ± 37.8	22	n/a				

Abbreviations: AF, atrial fibrillation; BMI, body mass index; Cryo, cryoballoon ablation; DOACs, direct oral anticoagulants; DM2, diabetes mellitus type 2; ICE, intracardiac echocardiogram; n/a, not available; ON, overnight; RFA, radiofrequency; SDD, same-day discharge; TEE, transesophageal echocardiogram; TIA, transient ischemic attack; UK, United Kingdom; USA, United States of America.

TABLE 2 Summary of selection criteria for SDD of included studies, and definitions of complications

First author, year	Total participants	SDD protocol	Definition of complications
Akula, 2020	571	Patients were monitored for at least 6 h post ablation and were reassessed by the nursing staff prior to discharge including inspection of groin access sites. SDD was cancelled if patient had any ablation related complications, non-ablation related medical care or due to patient specific/social reasons.	Death, pericardial tamponade, CVA, hematoma requiring PV stenosis, diaphragmatic paralysis or atrioesophageal fistula formation
Bartoletti, 2019	785	Patients remained on bed rest for 4 h and were subsequently mobilized in the presence of nursing staff; any bleeding from the femoral access site mandated another hour of bed rest before subsequent mobilization. After, patients were offered the choice of either staying overnight or going home in the absence of severe left ventricular dysfunction or a recent history of uncontrolled HF.	Not defined
Creta, 2020	2,628	Referring physicians identified patients who would not be suitable for SDD prior to the procedure. Patients were monitored for at least 4 h post ablation. In the absence of clinical concerns, suitable patients were discharged by the nurse with no physician review on the same day using a pre-specified workflow, including evaluation of the femoral access site, observations, national early warning score, electrocardiogram, and symptoms.	Death, cardiac tamponade, stroke or TIA, major vascular complications, bradyarrhythmia, persistent PN palsy, air embolus, esophageal fistula, gastroparesis, pharyngeal perforation
Deyell, 2020	3,054	Patients were monitored for up to 8 h. Patients were discharged if ambulation was well tolerated with no access site bleeding and vital signs were stable	Access site complication, pericardial effusion, CVA, PN palsy
He, 2020	967	Not reported	Hypotension requiring support, acute pulmonary edema, pericardial effusion/pericardial tamponade stroke, vascular injury/bleedingPN palsy, AV node injury
Kowalski, 2020	2,374	Patients were discharge on the same day if was cleared by the operator after the procedure based on clinical standards-of-care at each hospital with most patients with an intraprocedural complication not eligible for SDD.	Death, pericardial effusion, TIA, HF, hematoma, PN palsy, pericarditis
Mondrago Ignacio, 2018	195	Not reported	pericardial effusion requiring intervention, vascular complications, hematoma, PN injury
Opel, 2019	276	Patients were monitored for 4 h and were discharged if cleared by nurse.	Pericardial effusion or cardiac tamponade, pericarditis, bradycardia, vascular injury, PN injury, air embolus
Rajendra, 2020	82	Prior to procedure, patients needed to be on stable anticoagulation with no bleeding history, acceptable CHA2DS2-VASc stroke risk, BMI < 35, and without systolic HF, respiratory conditions, or interventional procedures within 60 days. After the procedure, patient can be discharged home if patients were hemodynamically stable, in the absence of any complications including groin or respiratory complications, able to ambulate and tolerate liquids/food. Confirmation needed to be made by operator to proceed with SDD.	Complications involving groin, respiratory, cardiac, or bleeding
Reddy, 2020	448	Patients were monitored on bed rest for 2 h. If groin haemostasis was acceptable and patients were clinically stable after this 2-h period they could be gently mobilised. If after a further 1-h observation, there were no evident complications anticoagulation could recommence and the patient could be discharged.	Death, cardiac tamponade, CVA, vascular complications, bradyarrhythmia, PN palsy, air embolus, pulmonary edema, leg numbness, migraine

AV, atrioventricular; BMI, body mass index; CVA, cerebrovascular accident; HF, heart failure; PN, phrenic nerve; PV, pulmonary vein; SDD, same-day discharge, TIA, transient ischemic attack.

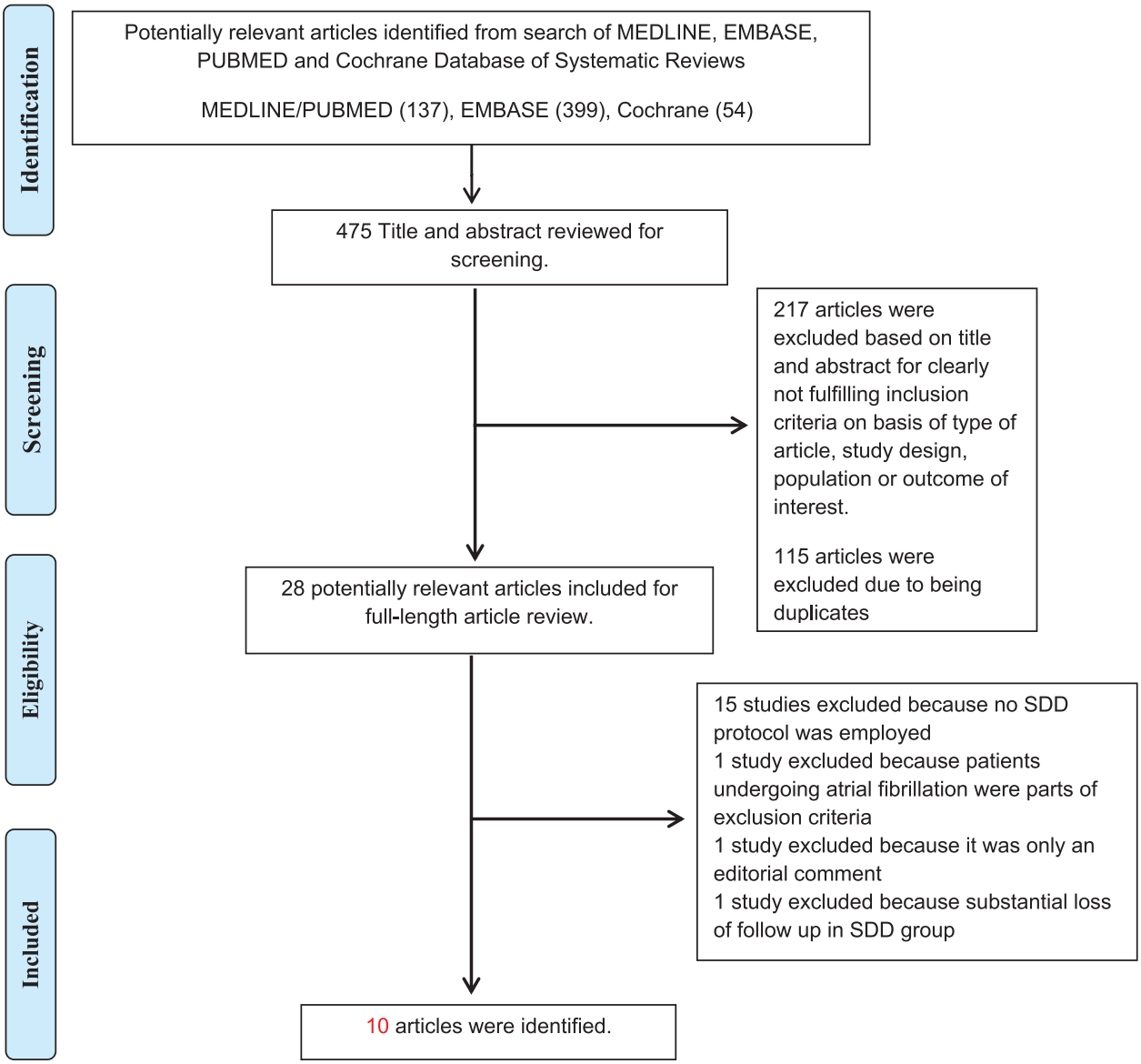

FIGURE 1 PRISMA flow diagram [Color figure can be viewed at wileyonlinelibrary.com]

95% CI 0.41–3.73, $p = .709$), pericardial complications (0.8% vs. 1.9%; pooled OR 0.64: 95% CI 0.20–1.98, $p = .433$) and phrenic nerve injuries (0.6% vs. 0.4%; pooled OR 1.26: 95% CI 0.24–6.64, $p = .783$) (Figure 3a and 3b).

3.4 | Exploratory analysis

Factors associated with increased likelihood of discharge on the same day were male gender (pooled OR 1.31: 95% CI 1.11–1.56, $p = .002$), use of conscious sedation (pooled OR 0.26: 95% CI 0.16–0.45, $p < .001$), and shorter procedural duration (pooled SMD—3.06 95% CI −4.12–2.00, $p < .001$). Age (pooled SMD—0.01: 95% CI −0.14–0.12, $p = .870$), hypertension (pooled OR 0.93: 95% CI 0.59–1.48, $p = .769$), previous ablation (pooled OR 0.93: 95% CI 0.51–1.69, $p = 0.807$), diabetes (pooled OR 1.07: 95% CI 0.89–1.29, $p = .466$), cardiomyopathy (pooled OR 0.84: 95% CI 0.51–1.38, $p = .490$), use of cryoablation (pooled OR 1.80: 95% CI 0.58–5.62, $p = .309$) and prior stroke (pooled OR 0.77: 95% CI 0.47–1.25, $p = .288$) were not associated with higher SDD rates.

3.4.1 | Publication bias

Publication bias was not found from funnel plots, Beggs' rank correlation, and Egger's linear regression test for both first and second primary outcomes (Supplementary file).

4 | DISCUSSION

Our systematic review and meta-analysis demonstrated that the SDD protocol for patients undergoing AF ablation was not associated with

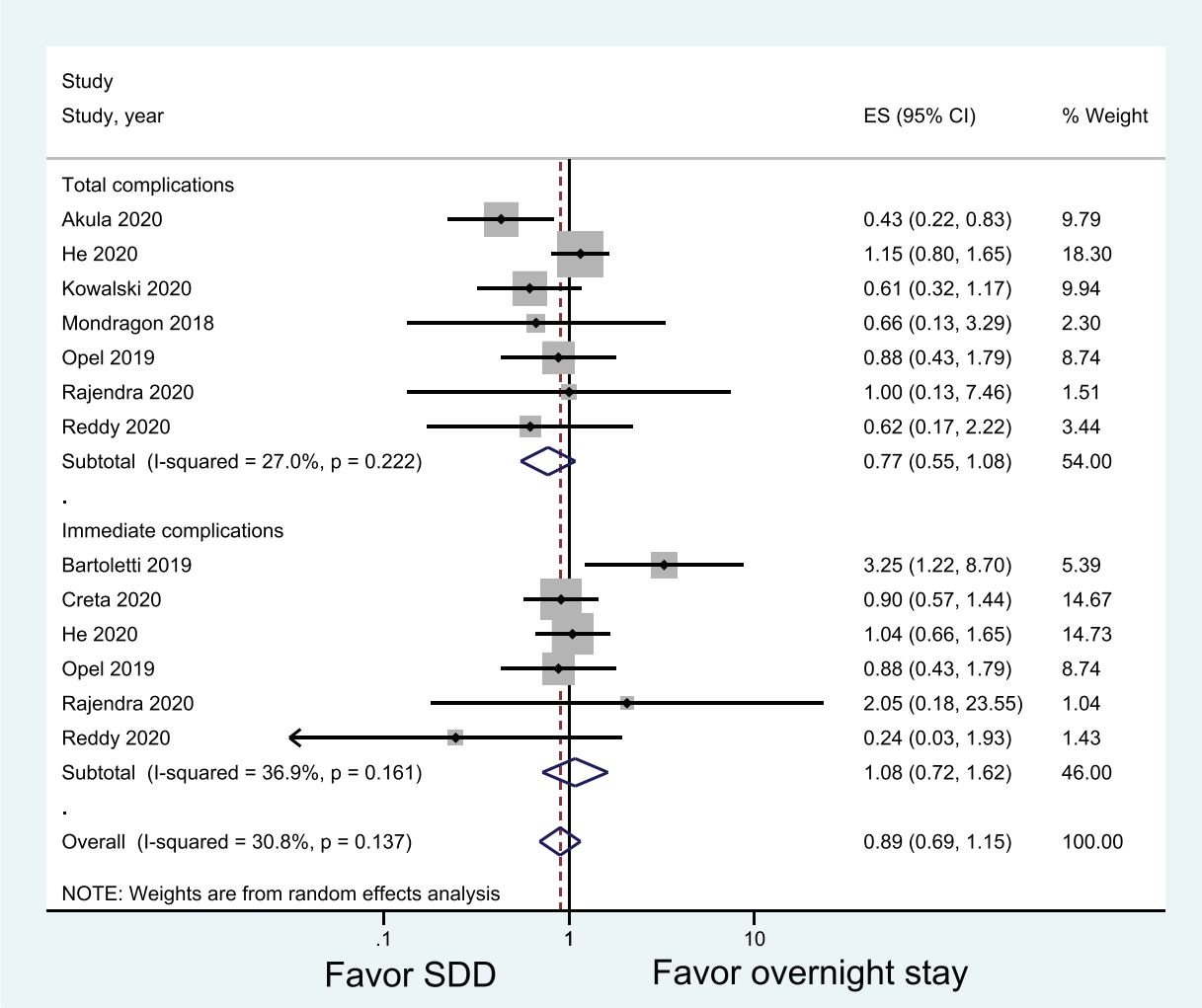

FIGURE 2 Forest plot of the included studies comparing total and immediate complications rates between SDD and overnight stay [Color figure can be viewed at wileyonlinelibrary.com]

higher immediate or total procedural complications than an overnight stay. The incidence rates of common complications, including bleeding, pericardial events, stroke/TIA, phrenic nerve injury, and death, were not significantly different in both groups. Moderate heterogeneity was observed given between-study differences, which was anticipated due to varieties in studies' protocols and methodologies. Of note, the exploratory analyses suggested that male gender, use of conscious sedation, shorter procedural duration were associated with successful discharge on the same day after AF ablation.

Overnight observation is a common practice after AF ablation due to the complexity of the procedure and the need of anticoagulation. Although this convention is reasonable, SDD after AF ablation may render better cost-effectiveness in-hospital resource utilization, especially in the era of COVID-19 pandemic. Recent studies from the UK highlighted considerable annual cost-savings, approximately 98 k to 126 k$, in implementing the SDD protocol compared with an overnight stay.[22–24] In our opinion, SDD plan for patients undergoing AF ablation does not only help minimize hospital stays and preserve available beds for sicker patients affected by the current worldwide COVID-19 outbreaks, but also provides an efficient and cost-reduced framework in the future.

Our study showed that total complication rates were not different in both primary and secondary outcomes between SDD and an overnight stay. Total complication rates from our analysis ranged from 3% to 5%, which were slightly lower than the previous reports.[32,33] The incidence of common complications in our study, especially bleeding events, was reported as low as 1.5%–2%. Similarly, the incidence rates of pericardial complication, stroke/TIA, and phrenic nerve injury were extremely low, significantly less than 1%, consistent with recent studies.[33,34] Moreover, mortality rate in our study was found extremely uncommon, < 0.01%. These findings may stem from tremendous improvement in catheter and three-dimensional mapping technologies, allowing shorter procedural times and fewer complications.[35,36] Use of echocardiography guided catheter ablation, both TEE and ICE, is another crucial factor that plays a significant role in facilitating shorter procedural duration, fluoroscopy time and doses, as well as fewer complications.[37,38] Direct visualization of cardiac anatomy in several stages during the procedure, especially transeptal puncture, ensures

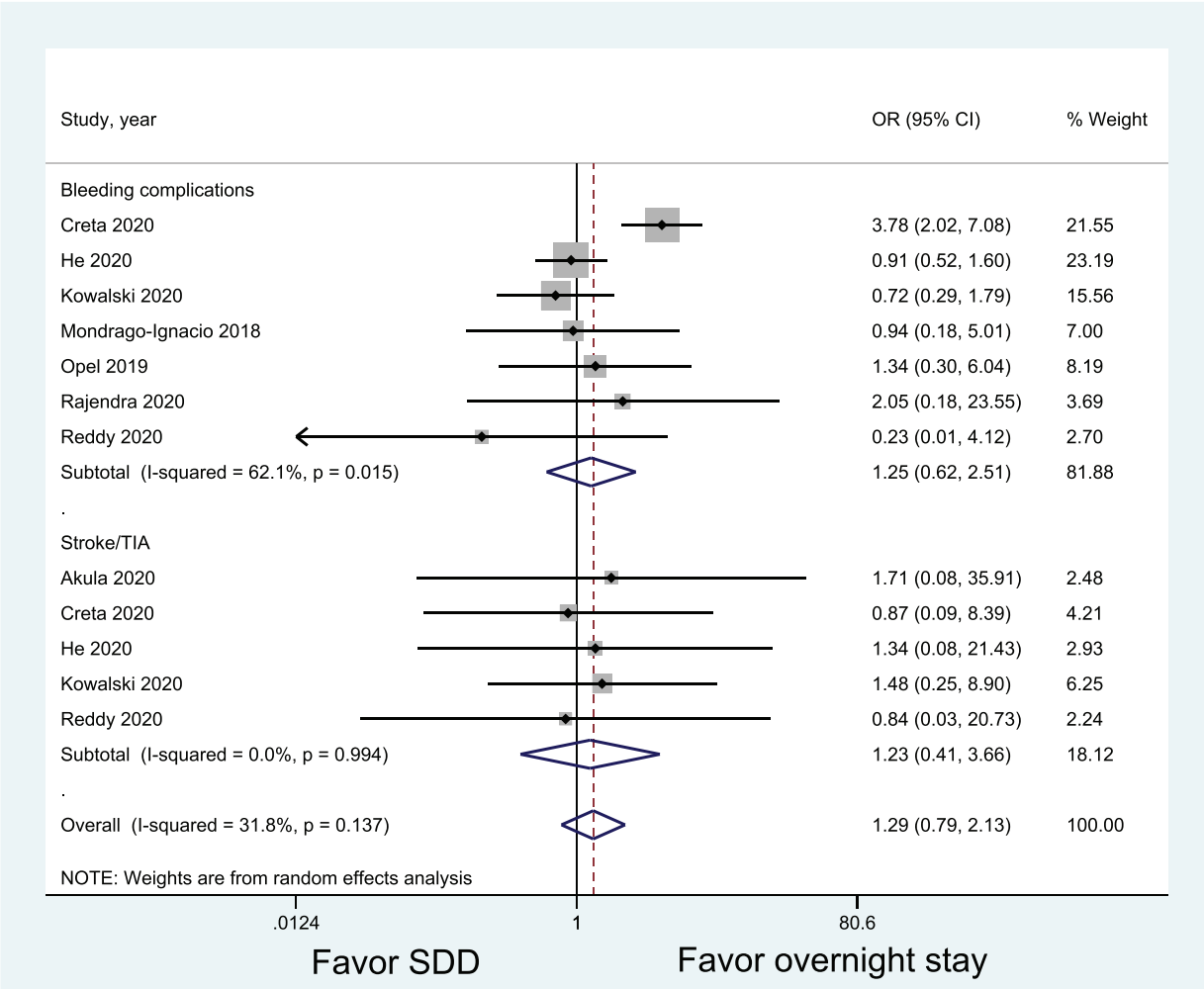

FIGURE 3a Forest plot of the included studies comparing bleeding complications and Strok/TIA between SDD and overnight stay [Color figure can be viewed at wileyonlinelibrary.com]

certain positions, mitigating risks of ruptures, tamponade, and pulmonary vein stenosis. The uninterrupted anticoagulation, as well as better postprocedural care, are also considered as one of the main contributions in these findings. Overall, the safety profile of SDD protocol is favorable, readily to be more implemented in clinical practices.

Considering SDD protocols from each study, similar strategies have been adopted, essentially in patients with stable hemodynamic status and the ability to ambulate post-procedurally. Some studies required proximity of patients' residential areas within designated ranges from hospitals as well as great social supports. Nevertheless, the decision whether patients were discharged or stayed overnight mostly derived from operators' discretion, owing to the absence of standardized guidelines for SDD plans. In our exploratory analysis, it is suggested that male gender, shorter procedural time, and conscious anesthesia are factors favoring SDD. Several studies reported substantially higher complication rates among females compared with males.[33,39,40] We speculate that gender-related anatomical differences, such as smaller heart and vascular structures, as well as smaller body sizes, in females compared with males, may impact the procedures difficulty.[41,42] Catheter manipulation under the limited spaces may theoretically predispose the higher complication risks. For this reason, a longer observation in females is anticipated after AF ablation procedure, as observed in our exploratory analysis. Also, the shorter procedural time and conscious anesthesia may expedite patients' recovery in periprocedural phases and lead to early discharge, especially prior to afternoon time in some studies' protocols.[25,29]

4.1 | Strength and limitation

Strengths of our study are as follows. First, this is the first and most comprehensive, and largest systematic review and meta-analysis to provide the current understanding in terms of safety profiles on SDD protocol in comparison with overnight stay. Second, from our pool database, we investigated with our best to explore if any clinical factors could favor successful SDD. Despite the hypothesis-generating context, we believe this information is useful in determining potential candidates for SDD. Third, the generalizability of our analysis well suffices,

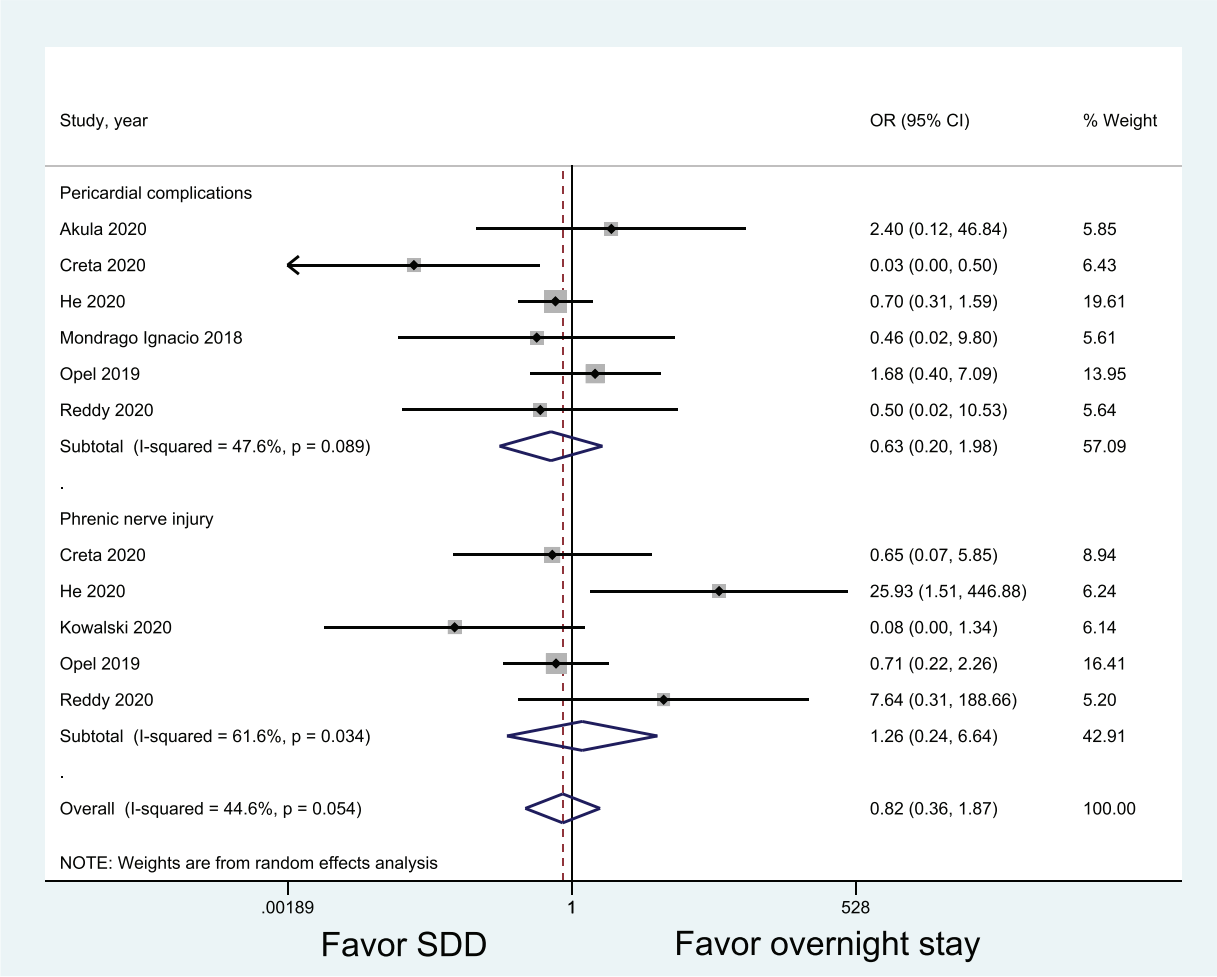

FIGURE 3b Forest plot of the included studies comparing pericardial complications and phrenic nerve injuries between SDD and overnight stay [Color figure can be viewed at wileyonlinelibrary.com]

given a vast diversity in patients demographics, settings, and procedural protocols from included studies.

Yet, this study is imperfectly not without limitations. First, owing to the inclusion of observational studies, residual confounders are inevitable, especially selection bias from pre-defined inclusion criteria of SDD protocol. Nevertheless, our analysis represented the performance of these protocols in the setting of real-world experience, which should exert better practicalities. Second, study heterogeneity was observed. This was expected due to differences in SDD protocols, follow-up duration, use of echocardiography-guided catheter ablation, centers' experience, variations in AF ablation procedures and techniques, periprocedural care, and outcomes definitions. Third, postprocedural echocardiogram protocol was also vastly varying from each study which may result in an underestimated pericardial/intracardiac complication detection. Fourth, satisfactory rates and economic impacts were not analyzed due to insufficiency of the existing data. Fifth, total complications were non-uniformly defined in each study. We hence decided to assess common complications individually, showing the similar trend with the primary outcome. In addition, our sensitivity analysis, performed by omitting one study each time, confirmed no statistical differences, further verifying robustness of our study.

5 | CONCLUSION

Our study encouraged the use of SDD in patients undergoing AF ablation since there are no major differences in complication rates compared with overnight stay. Despite comprehensive analysis of pooled real-world data, further studies, especially RCTs, are needed to confirm the present findings.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data for this systematic review and all potentially eligible studies are publicly available through the Open Science Framework (URL: https://osf.io/uayp5/).

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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