

Is thyroid disease associated with post-operative complications after total joint arthroplasty? A systematic review

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INTRODUCTION

Thyroid hormones exert widespread and complex action in almost all human tissues, including bone remodeling and articular cartilage health. However, the evaluation of thyroid dysfunction influence on primary total joint arthroplasty (TJA) outcomes is limited.. This comprehensive systematic review aims to assess the literature regarding the risk of postoperative complications in patients undergoing TJA with concomitant thyroid dysfunction.

METHODS

Databases utilized: PubMed, Cochrane Central Register of Controlled Trials (CENTRAL), Scopus, and ClinicalTrials.gov (end of search: May 2022)

Primary outcomes: Rates of post-operative complications, divided into four categories: implant-related, blood loss, infection and postoperative medical complications.

- Inclusion criteria:**
- Randomized control and case-control studies, cohort and observational clinical studies
 - Patients undergoing replacement of major joints (Hip, Knee, Elbow, Ankle)
 - Studies that included adult patients with thyroid dysfunction

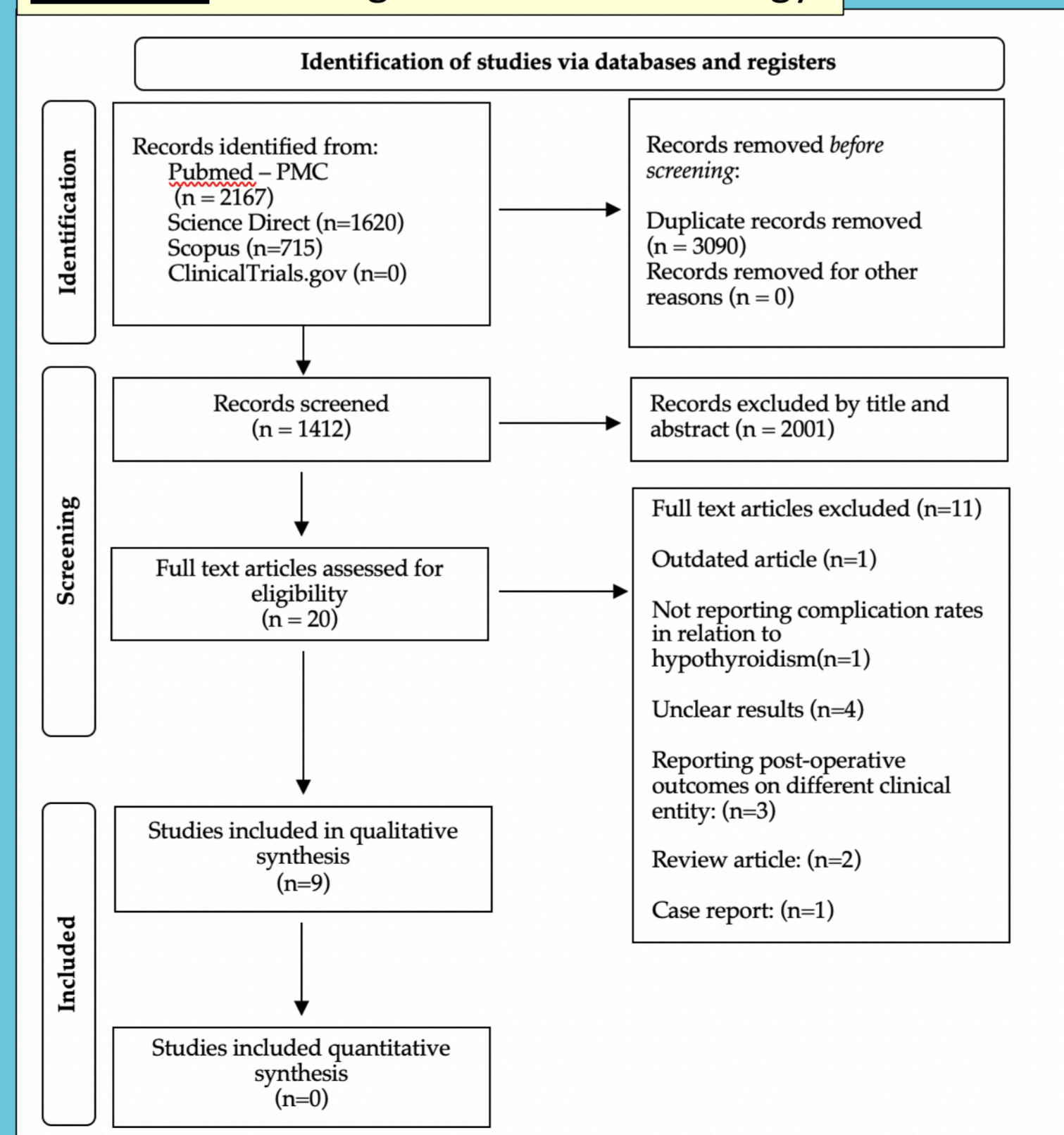
Methodological assessment of the included studies performed using the **Newcastle-Ottawa scale**

Table 1. General studies information, patients' characteristics, and study design of included studies.

Author	Date	Study Type	Arthroplasty Joint	Thyroid disease patients (control/non-thyroid disease)	Sex (F/M)	Age at TJA (years)	Follow-up (Months)
Tan et.al.	2016	RO	Hip + Knee	4008 (29281)	18252/14037	63.98	N/A
Althoff et.al.	2018	RO	Ankle	6977 TAA 2010 Hypothyroid	N/A	N/A	N/A
Buller et.al.	2018	RC	Knee	98555 (98555)	162612/34498	N/A	N/A
Shahi et.al.	2019	RO	Hip + Knee	4873	2714/ 2159	Hip 65 Knee 63.7	12
Somerson et.al.	2019	RC	Elbow	1452	1132/106	PJI 62 No PJI 60	3
Yuan et.al.	2020	RC	Knee	134 (134)	232/36	TD 67.29 No TD 65.96	69.6
Yuan et.al.	2020	RC	Hip	63 (63)	68 /58	TD 53.4 No TD 56.1	78
Wen Jing et al.	2021	CS	Knee	398 (398)	700 /96	TD: 64.8 No TD: 65.1	25.4
Yang et.al.	2021	RO	Knee	8484 PCRs 1.218.760 no PCRs	771385 / 455859	No PCRs: 67 PCRs: 64	N/A

Nine studies were included in this review
One study presented data on total ankle arthroplasty
Four studies presented data on total knee arthroplasty (TKA)
One study included data on total hip arthroplasty (THA)
One for total elbow arthroplasty
Two studies demonstrated data on both TKA and THA

Figure 1. Flow diagram of search strategy.



RESULTS

Data regarding **1,472,135** total arthroplasty operations were included

In two studies, the rate of **deep venous thrombosis**, **pneumonia** and non-specified **cardiac complications** was significantly increased among hypothyroid patients.

Significant increases among hypothyroid patients were also calculated in the rates of **stroke** (3.8% vs 0.8%), **urinary tract infections** (2.8% vs 0.5%), and **pulmonary complications** (3% vs 0.8%) respectively.

Table 1. Post-operative medical complications in the included studies.

Author	Postoperative Complications	Hypothyroid group n, (%)	Control group n, (%)	O.R.	95% C.I.	p-value
Wen Jing et.al.	Sepsis	12 (3)	3 (0.8)	4.10	3.80-4.31	0.037
	DVT	13 (3.3)	3 (0.8)	4.45	4.23-4.67	0.023
	Pneumonia	11 (2.8)	3 (0.8)	3.76	3.57-3.95	0.037
	Cardiac Complications	14 (3.5)	4 (1)	3.59	3.41-3.77	0.032
	Stroke	15 (3.8)	3 (0.8)	5.16	4.90-5.42	0.009
	UTI	11 (2.8)	2 (0.5)	5.63	5.35-5.91	0.025
	Pulmonary Insufficiency	12 (3)	3 (0.8)	4.10	3.80-4.31	0.037
	Readmission	21 (5.3)	6 (1.5)	3.64	3.46-3.82	0.006
	Intubation	2 (0.5)	1 (0.3)	2.00	1.90-2.10	0.998
	PE	4 (1)	0 (0)	4.12	3.83-4.32	0.180
	AKI	4 (1)	1 (0.3)	4.03	3.83-4.23	0.370
Buller et.al.	Thrombocytopenia	276 (0.28)	166 (0.17)	1.577	1.303-1.910	<.001
	Intubation	98 (0.10)	69 (0.07)	1.524	1.114-2.084	0.008
	PE	276 (0.28)	226 (0.23)	1.206	1.012-1.437	0.036
	DVT	650 (0.66)	522 (0.53)	1.252	1.115-1.406	<.001
	Pneumonia	532 (0.54)	335 (0.34)	1.579	1.377-1.810	<.001
	AKI	581 (0.59)	443(0.45)	1.304	1.152-1.477	<.001
	Cardiac Complications	39 (0.04)	39(0.04)	0.897	0.569-1.416	0.642
	Vascular Complications	20 (0.02)	30 (0.03)	0.92	0.522-1.621	0.773
	Urinary Complications	20 (0.02)	20(0.02)	1	0.561-1.783	1.00
	Pulmonary Complications	20 (0.02)	30 (0.03)	0.75	0.426-1.321	0.317
	MI	138 (0.14)	108 (0.11)	1.217	0.946-1.564	0.126
Yuan et.al.	IM venous thrombosis	2 (1.49)	13 (9.70)			0.001
	PE	0 (0)	0 (0)			1.00
	DVT	0 (0)	0 (0)			1.00
	AKI	0 (0)	1 (0.75)	N/A	N/A	1.00
	Cardiac failure	1 (0.75)	1 (0.75)			1.00
	Wound Complications	3 (2.24)	3 (2.24)			1.00
	Urinary Complications	0 (0)	1 (0.75)			1.00
Yuan et.al.	Liver dysfunction	1 (1.59)	1 (1.59)			1.00
	HF	1 (1.59)	2 (3.17)			1.00
	Pulmonary Infection	1 (1.59)	0 (0)			1.00
	UTI	0 (0)	1 (1.59)	N/A	N/A	1.00
	Wound Complications	2 (3.17)	1 (1.59)			1.00
	IM vein Thrombosis	2 (3.17)	10 (15.87)			0.015
Readmission rate	1 (1.59)	2 (3.17)			1.00	

All studies reporting perioperative blood loss-related complications demonstrated a significantly higher rate of postoperative anemia in hypothyroid patients undergoing arthroplasty.

Significant increase in intra- and postoperative blood loss in hypothyroid patients during the first postoperative day were also reported

Table 2. Blood-loss related complications of patients in included studies.

Author	Blood-loss related complications	Hypothyroid group n, (%)	Control group n, (%)	O.R.	95% C.I.	p-value
Wen Jing et.al.	Transfusion	78 (19.6)	60 (15.1)	1.37	1.30-1.44	0.03
	Anemia	29 (7.3)	17(4.3)	1.76	1.67-1.85	0.039
Buller et.al.	Post-operative blood loss	404 (0.41)	315 (0.32)	1.252	1.080-1.451	0.03
	Anemia	1212 (1.23)	848 (0.86)	1.428	1.307-1.561	<0.01
Yuan et.al.	Transfusion	1902 (1.93)	1429(1.45)	1.321	1.237-1.422	<0.01
	Anemia	10 (7.46)	4 (2.99)	N/A	N/A	0.1
Yuan et.al.	Transfusion	123 (91.79)	107 (79.85)	N/A	N/A	0.01
	Anemia	7 (11.11)	2 (3.17)	N/A	N/A	0.084
Yuan et.al.	Transfusion	57 (90.48)	48 (76.3)	N/A	N/A	0.031
	Anemia					

The included studies reported **no significantly different rates of aseptic loosening** between groups. One study reported significantly higher dislocation rates among hypothyroid patients

Table 3. Prosthesis-related complications in the included studies.

Author	Mechanical Complications	Hypothyroid group n, (%)	Control group n, (%)	O.R.	95% C.I.	p-value
Wen Jing et.al.	Peri-prosthetic fracture	1 (0.3)	0 (0)	1.00	0.95-1.05	0.317
Buller et.al.	Aseptic loosening	69 (0.07)	60 (0.06)	1.119	0.787-1.590	0.531
	Dislocation	453 (0.46)	355 (0.36)	1.258	1.095-1.446	0.01
	Broken implant	20 (0.02)	20 (0.02)	1.05	0.569-1.937	0.876
	Peri-prosthetic fracture	177 (0.18)	148 (0.15)	1.153	0.927-1.434	0.202
Yuan et.al.	Other	60 (0.06)	39 (0.04)	1.6	1.078-2.376	0.019
	Aseptic loosening	0 (0)	0 (0)	N/A	N/A	1
Yuan et.al.	Aseptic loosening	0 (0)	0 (0)	N/A	N/A	1

Two studies reported a statistically significant increase in **periprosthetic joint infection** in hypothyroid patients

Table 4. Periprosthetic joint infection in included studies.

Author	Hypothyroid group n, (%)	Control group n, (%)	O.R.	95% C.I.	p-value
Wen Jing et.al.	2 (0.5)	0 (0)	2.0	1.90-2.10	0.99
Tan et.al.	135 (3.4)	348 (1.4)	2.46	1.99-3.05	<0.01
Buller et.al.	345 (0.35)	227 (0.23)	1.502	1.271-1.775	<0.01
Yuan et.al.	1 (0.75)	0 (0)	N/A	N/A	1
Yuan et.al.	1 (1.59)	0 (0)	N/A	N/A	1

CONCLUSIONS

Hypothyroidism has been identified as a potential but modifiable risk factor leading to increased perioperative TJA complications including blood loss, periprosthetic joint infection and various medical complications. Our results suggest that a more robust understanding of the pathophysiologic changes seen in hypothyroid patients is necessary to elucidate better the potential higher risk of complications and outcomes in the TJA population. Prospective high-quality trials are certainly needed.

