Search Strategy of literature database

1. MEDLINE + PMC (PubMed) Last running date of literature searching December 25th 2024.
#1: "bradycardia"[Title/Abstract] OR "bradyarrythmia"[Title/Abstract] OR "bradydysrhythmia"[Title/Abstract] OR "bradyarrhythmia"[Title/Abstract] OR "bradyarrhytmia"[Title/Abstract] OR "bradycardia"[MeSH Terms]

#2: "heart block"[MeSH Terms:noexp] OR "heart block"[Title/Abstract]

#3: "atrioventricular block"[Title/Abstract] OR "av block"[Title/Abstract] OR "a v block"[Title/Abstract] OR "atrioventricular block"[MeSH Terms]

#4: "Adams-Stokes"[Title/Abstract] OR "Stokes-Adams"[Title/Abstract] OR "adams stokes syndrome"[MeSH Terms]

#5: "interatrial block"[MeSH Terms] OR "interatrial block"[Title/Abstract] OR "bayes syndrome"[Title/Abstract] OR "interatrial conduction delay"[Title/Abstract] OR "delayed interatrial conduction"[Title/Abstract] OR "inter-atrial block"[Title/Abstract] OR "inter-atrial conduction delay"[Title/Abstract]

#6: "sick sinus syndrome"[MeSH Terms] OR "sick sinus"[Title/Abstract] OR "sinus node"[Title/Abstract] OR "SND"[Title/Abstract]

#7: "sinoatrial block"[MeSH Terms] OR "sinoatrial exit"[Title/Abstract] OR "sinoatrial block"[Title/Abstract]

#8: "arrhythmia"[Title/Abstract] OR "arrythmia"[Title/Abstract] OR "dysrhythmia"[Title/Abstract] OR "arhythmia"[Title/Abstract] OR "arythmia"[Title/Abstract] OR "arrhytmia"[Title/Abstract] OR "arrhythmias, cardiac"[MeSH Terms:noexp]

#9: "Myocardial Ischemia"[MeSH Terms:noexp] OR "myocardial infarction"[MeSH Terms:noexp] OR "acute coronary syndrome*"[Title/Abstract] OR "AMI"[Title/Abstract] OR "ACS"[Title/Abstract] OR "acute coronary syndrome"[MeSH Terms] OR "acute myocardial infarction*"[Title/Abstract] OR "acute myocardial isch*"[Title/Abstract]

#10: #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9

#11: "atropine"[Title/Abstract] OR "atropine"[MeSH Terms]

#12: #10 AND #11

#13: 0001/01/01:2024/12/16 [Date - Create]

#14: #12 AND #13

#15: "animals"[MeSH Terms] NOT "humans"[MeSH Terms]

#16: #14 not #15

2. Science Citation Index Expanded(Web of Science) Last running date of literature searching:, December 25th 2024.

#1: TS=bradycardia OR TS=bradyarrythmia OR TS=bradydysrhythmia OR TS=bradyarrhythmia OR TS=bradyarrhytmia

#2: TS="heart block"

#3: TS="atrioventricular block" OR TS="av block" OR TS="a v block"

#4: TS=Adams-Stokes OR TS=Stokes-Adams

#5: TS="interatrial block" OR TS="bayes syndrome" OR TS="interatrial conduction delay" OR TS="delayed interatrial conduction" OR TS="inter-atrial block" OR TS="inter-atrial conduction delay"

#6: TS="sick sinus" OR TS="sinus node" OR TS=SND

#7: TS="sinoatrial exit" OR TS="sinoatrial block"

#8: TS=arrhythmia OR TS=arrythmia OR TS=dysrhythmia OR TS=arhythmia OR TS=arythmia OR TS=arrhytmia

#9: TS="acute coronary syndrome*" OR TS=AMI OR TS=ACS OR TS="acute myocardial infarction*" OR TS="acute myocardial isch*"

#10: #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9

#11: TS=atropine

#12: #10 AND #11

#13: SU=(Cardiovascular System & Cardiology) OR WC=(Cardiac & Cardiovascular Systems) OR WC=(Emergency Medicine) OR SU=(Emergency Medicine) OR WC=(Medicine, General & Internal) OR SU=(General & Internal Medicine) OR WC=(Critical Care Medicine) OR SU=(Critical Care Medicine)

#14: #12 AND #13

#15: #14 with restriction of indexed date from 1973-01-01 to 2024-12-16

3. Cochrane Central Register of Controlled Trials(Cochrane Library) Last running date of literature searching:,

December 25th 2024.

#1: bradycardia:ti,ab,kw OR bradyarrythmia:ti,ab,kw OR bradydysrhythmia:ti,ab,kw OR bradyarrhythmia:ti,ab,kw OR bradyarrhytmia:ti,ab,kw OR [mh bradycardia]

#2: [mh ^"heart block"] OR "heart block":ti,ab,kw

#3: "atrioventricular block":ti,ab,kw OR "av block":ti,ab,kw OR "a v block":ti,ab,kw OR [mh "atrioventricular block"]

#4: Adams-Stokes:ti,ab,kw OR Stokes-Adams:ti,ab,kw OR [mh "adams stokes syndrome"]

#5: [mh "interatrial block"] OR "interatrial block":ti,ab,kw OR "bayes syndrome":ti,ab,kw OR "interatrial conduction delay":ti,ab,kw OR "delayed interatrial conduction":ti,ab,kw OR "inter-atrial block":ti,ab,kw OR "inter-atrial conduction delay":ti,ab,kw

#6: [mh "sick sinus syndrome"] OR "sick sinus":ti,ab,kw OR "sinus node":ti,ab,kw OR SND:ti,ab,kw

#7: [mh "sinoatrial block"] OR "sinoatrial exit":ti,ab,kw OR "sinoatrial block":ti,ab,kw

#8: arrhythmia:ti,ab,kw OR arrythmia:ti,ab,kw OR dysrhythmia:ti,ab,kw OR arhythmia:ti,ab,kw OR arythmia:ti,ab,kw OR arrhytmia:ti,ab,kw OR [mh ^"arrhythmias, cardiac"]

#9: [mh ^"Myocardial Ischemia"] OR [mh ^"myocardial infarction"] OR ("acute coronary" NEXT syndrome*):ti,ab,kw OR AMI:ti,ab,kw OR ACS:ti,ab,kw OR [mh "acute coronary syndrome"] OR ("acute myocardial" NEXT infarction*):ti,ab,kw OR ("acute myocardial" NEXT isch*):ti,ab,kw

#10: #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9

#11: atropine:ti,ab,kw OR [mh atropine]

#12: #10 AND #11

#13: #12 with Date added to CENTRAL trials database from 01/01/0001 to 16/12/2024

4. Japana Centra Revuo Medicina/Igaku Chuo Zasshi(Ichushi-Web) Last running date of literature searching:, December 25th 2024..

#1：((bradycardia/TA) or (bradyarrythmia/TA) or (bradydysrhythmia/TA) or (bradyarrhythmia/TA) or (bradycardia/TA) or (徐脈/TH) or (徐脈/TA) or (徐拍/TA))

#2: (("heart block"/TA) or (@心ブロック/TH) or (心ブロック/TA) or (心臓ブロック/TA))

#3: (("atrioventricular block"/TA) or ("AV block"/TA) or ("A-V block"/TA) or (房室ブロック/TH) or (房室ブロック/TA) or (AV ブロック/TA) or (A-V ブロック/TA) or (房室伝導ブロック/TA))

#4: (("Adams-Stokes"/TA) or ("Adams Stokes"/TA) or ("Stokes-Adams"/TA) or ("Stokes Adams"/TA) or (アダムス-ストークス/TA) or (アダムスストークス/TA) or (アダムス・ストークス/TA) or (ストークス・アダムス/TA) or (Adams-Stokes 症候群/TH))

#5: (("Interatrial Conduction Delay"/TA) or (心房間ブロック/TH) or (心房内ブロック/TA) or (心房ブロック/TA) or (房間ブロック/TA) or (心房間伝導障害/TA) or (心房間伝導遅延/TA) or (心房内伝導遅延/TA))

#6: ((洞不全症候群/TH) or (SND/TA) or ("sinus node"/TA) or ("sick sinus"/TA) or (洞機能不全/TA) or (洞不全/TA))

#7: ((洞ブロック/TA) or (洞房ブロック/TA) or (洞房ブロック/TH) or ("sinoatrial block"/TA) or ("sinoatrial exit"/TA))

#8: ((arrhythmia/TA) or (arrythmia/TA) or (dysrhythmia/TA) or (arhythmia/TA) or (arythmia/TA) or (arrhytmia/TA) or (@不整脈/TH) or (不整脈/TH) or (不整脈/TA) or (心律動異常/TA) or (脈拍異常/TA))

#9: (("Acute Myocardial Ischemia"/TA) or ("Acute myocardial infarction"/TA) or (ACS/TA) or (AMI/TA) or ("acute coronary syndrome"/TA) or (急性冠動脈症候群/TH) or (急性冠動脈症候群/TA) or (急性冠症候群/TA) or (@心筋梗塞/TH) or (急性心筋梗塞/TA) or (急性心筋虚血/TA) or (@心筋虚血/TA))

#10: #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9

#11: Atropine/TH or Atropine/TA or アトロピン/TA

#12: #10 and #11

#13: (#12) and (PT=原著論文)

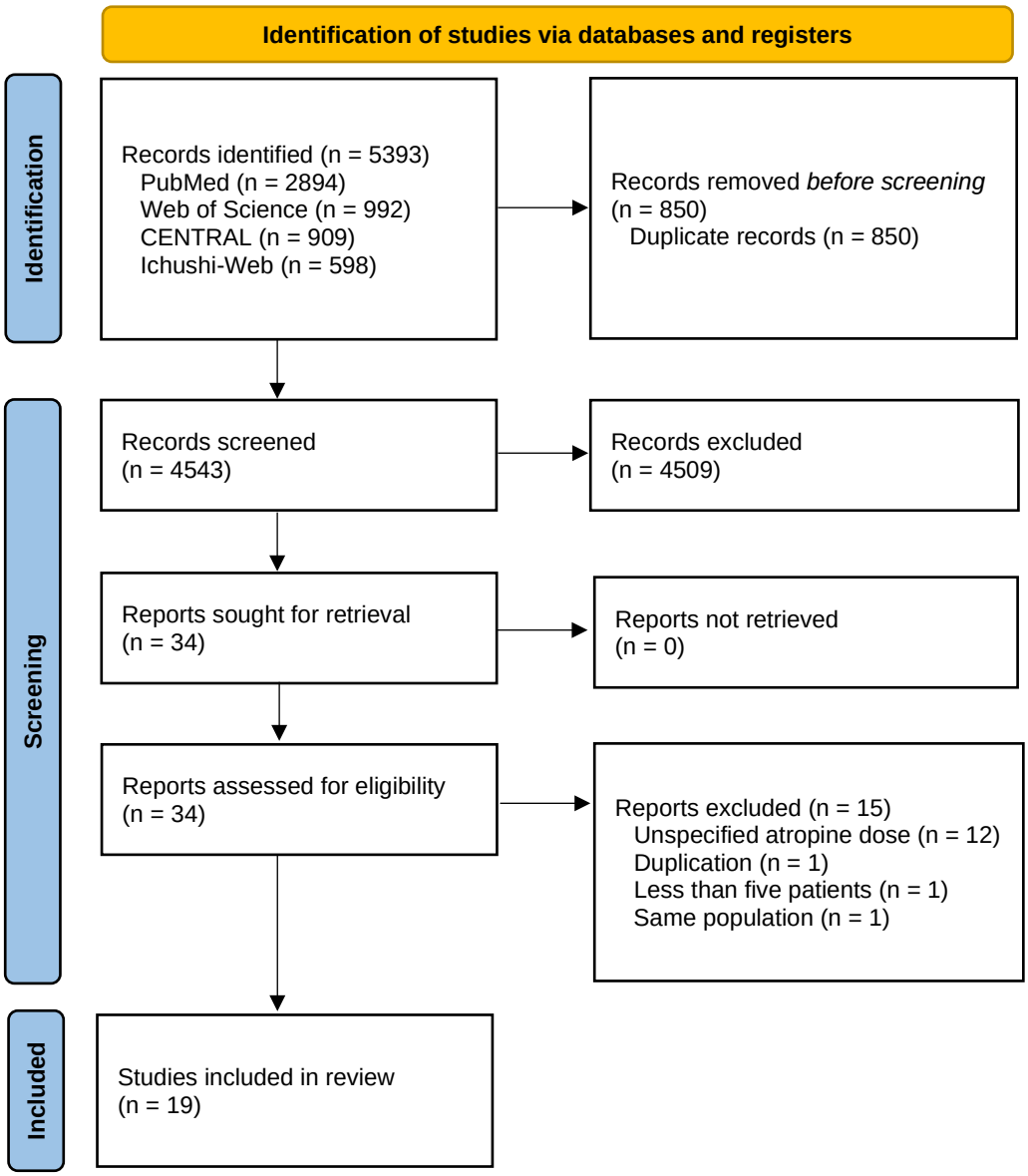
#14: DT=0001:2024 and PDAT=0001/01/01:2024/12/16

#15: #13 and #14

#16: ((動物/TH or CK=動物) not (ヒト/TH or CK=ヒト))

#17: #15 not #16

PRISMA flow chart



Study	Article type	Number of patients	Clinical setting	Atropine dose	Weight-based dose	Heart rate change	Adverse effects
Nishikawa 1990[13]	Case series	74	Operating room; patients under spinal anesthesia	Low dose (2 μg/kg (n=18), 4 μg/kg (n=21), 6 μg/kg (n=35))	2 μg/kg (n=18), 4 μg/kg (n=21), 6 μg/kg (n=35)	significant increase in 4μg/kg (17±16%) and 6μg/kg (20±12%) groups (mean±SD, changes from baseline); no significant change in 2 μg/kg group	Decreased heart rate (56% of 2μ/kg, 9% of 4μg/kg, 3% of 6μg/kg)
Smith 1994[14]	Case series	15	Operating room; patients undergoing radical prostatectomy with general anesthesia	Low dose (5 μg/kg (n=15))	5 μg/kg (n=15)	HR to ≥70 bpm in median 270 sec (range 30–490 s); 10 required second dose	Recurrent Bradycardia (n=5)
Adgey 1968[15]	Observational study	126	Mobile intensive-care unit; patients with AMI	Low-moderate dose (aliquots of 0.6 mg (minimum 0.3 mg))	N/A	Atropine was administered until a satisfactory ventricular rate and 64% of patients showed prompt systolic BP increase Atropine effect on AV conduction was influenced by the time of onset of AVB. Within 8hours: 10/20 (50%) improved AVB, 5/20(25%) improved to normal AV conduction. Over 8 hours: 1/11 (9%) showed favourable response	Ventricular extrasystoles in a few patients

Choi 2021[16]	Observational study	46	Operating room; patients undergoing open shoulder arthrotomy with general anesthesia	Moderate dose (0.5 mg)	N/A	Unspecified	Unspecified
Fujii 2018[17]	Observational study	108	Operating room; patients with transurethral, perineal, and lower limb surgery with spinal anesthesia	Moderate dose (0.5 mg)	N/A	Shown in the figure; however, exact value unspecified	Unspecified
Carp 1979[18]	Case series	23	Unspecified setting; patients with AMI	Moderate-high dose (0.8 or 1.0mg)	N/A	HR increased in 14/15 (93%) sinus bradycardia (≥ 20%: 12/15 (80%), 5-20%: 2/15 (13%) AVB improved in 9/16(56%) patients	Atrial flutter (n=1), ventricular escapes (n=1), ventricular paroxysmal tachycardia (n=1), ventricular flutter (n=1), cardiac arrest (n=3)
Chadda 1975[19]	Observational study	68	Emergency room or coronary care unit; patients with AMI	Moderate-high dose (0.6–1.0 mg)	N/A	From 46±14 to 79±12 bpm in 61/68 patients	Anginal chest pain (n=2), urinary retention (n=1)

Feigl 1984[20]	Case series	27	Coronary care unit: patients with AMI	Moderate-high dose (0.5–1.0 mg)	N/A	Complete restoration in normal conduction (n=5), elevated by 21-45/min (mean 28) (n=12), elevated by 10-35/min (mean 16) (n=8)	Unspecified
Okuyan 2010[21]	Case series	40	Coronary care unit; patients with mad honey intoxication	Moderate-high dose (0.5–1.0 mg)	N/A	Responded well (33/40, 82.5%); however, exact value unspecified	Unspecified
Scheinman 1975[22]	Observational study	56	Coronary care unit; patients with acute AMI	Moderate-high dose (0.5–1.0 mg (0.6 mg (n=34), 1.0 mg (n=15), unspecified (n=5))	N/A	Absolute or mean increase in HR were +32/min (0.5 or 0.6 mg), +27/min (0.8 mg), and +35/min (1.0 mg).	VT or VF (3/56, 5.3%), sustained sinus tachycardia (3/56, 5.3%), PVCs (3/56, 5.3%), psychosis (1/56, 1.8%)
Swart 1999[23]	Observational study	131	Prehospital and emergency department; patients with AMI	Moderate-high dose (0.97 ± 0.55 mg (n=131, total amount during prehospital interval), 1.2 ± 0.96 mg (n=56, total amount during ED interval), 1.5 ± 1.0 mg	N/A	NSR during hospital care (34/131, 26%), during ED care (17/131, 13%), and over course of care (41/131, 31.3%)	Frequent PVC (n=3), acute myocardial infarction (n=1), myocardial ischemia (n=1), VT (n=1), others (n=2)

				(n=131, total amount during total course of care))			
Thomas 1966[24]	Case series	6	Intensive care unit: patients with AMI	Moderate-high dose (0.6 mg (n=4), 1.2 mg (n=2))	N/A	HR increased to normal range (n=6) (0.6mg (n=3): +44±24/min, 0.6mg (n=1): to normal HR, 1.2mg (n=2): +55±21/min)	Excessive increase in blood pressure (n=2), dry mouth (n=1), visual hallucination (n=1)
Altun 1998[25]	Observational study	8	Unspecified setting; patients with AMI	High dose (1.0 mg)	N/A	No change in atrial rate, AV conduction, or ventricular rate in 15 min after atropine administration	Unspecified
Morrison 2008[26]	Randomized controlled trial	Unspecified	Prehospital; patients with symptomatic bradycardia	High dose (1.0 mg)	N/A	Unspecified	Unspecified
Onodera 1992[27]	Case series	19	Unspecified setting; patients with AMI	High dose (1.0 mg)	N/A	Shown in the figure; however, exact value unspecified	Unspecified
Varriale 1992[28]	Observational study	6	Coronary care unit; patients with AMI	High dose (1.0 mg)	N/A	HR restoration to normal range (n=6)	Unspecified
Chadda 1977[29]	Observational study	100	Unspecified setting; patients with AMI	Variable dose (0.4-0.6 mg (n=72), 0.8-	N/A	The mean increase in HR was 50±23 in the group receiving ≧ 0.8 mg, 31±18 in the group receiving 0.4-	Angina with increased HR after atropine 0.8 mg(n=2),

				1.5 mg (n=28))		0.6 mg Higher number of patients in the group given ≧ 0.8 mg (16/28, 56.9%) had an inappropriate response (HR≧100/min) when compared with those given the 0.4 to 0.6 mg dose (7/72, 9.6%)	increased frequency in PVC (n=2)
Klein 1975[30]	Observational study	17	Coronary care unit; patients with AMI	Variable dose (0.3mg (n=2), 0.4mg (n=1), 0.5mg (n=3), 0.6mg (n=6), 0.8mg (n=1), 1.0mg (n=4))	0.0053-0.0088 mg/kg (n=11), 0.0120-0.0148 mg/kg (n=3), 0.0089-0.0119 mg/kg (n=3)	Increase 20-72/min from baseline in 0.0053-0.0088 mg/kg (n=11), 51-92/min in 0.0120-0.0148 mg/kg (n=3), unspecified in 0.0089-0.0119 mg/kg (n=3)	HR>120/min (n=4), AV dissociation (n=4)
Wei 1983[31]	Observational study	9	Unspecified setting; patients with AMI	Variable dose (0.4–1.0 mg)	N/A	Responded after atropine administration (n=9)	Unspecified