Supplemental Material

Right Ventricle Outflow Tract Obstruction in Adults: A Systematic Review

By Zeng, et al.

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Supplemental Appendix S1. PubMed search query (last accessed August 15th, 2020)

Advanced Search

((("RVOTO"[All Fields] OR ("ventricular outflow obstruction/surgery"[MeSH Major Topic] AND "right"[Title/Abstract])) OR ((("right ventricular outflow"[Title/Abstract] OR "right ventricle outflow"[Title/Abstract]) AND (("tract"[All Fields] OR "tract s"[All Fields]) OR "tracts"[All Fields])) AND (((((("constriction, pathologic"[MeSH Terms] OR ("constriction"[All Fields] AND "pathologic"[All Fields])) OR "pathologic constriction"[All Fields]) OR "stenosi"[All Fields]) OR "stenosis"[All Fields]) OR ((((((("obstruct"[All Fields] OR "obstructed"[All Fields]) OR "obstructing"[All Fields]) OR "obstruction"[All Fields]) OR "obstructions"[All Fields]) OR "obstructive"[All Fields]) OR "obstructs"[All Fields])))) AND (((((((("thoracic surgery"[MeSH Terms] OR ("thoracic"[All Fields] AND "surgery"[All Fields])) OR "thoracic surgery"[All Fields]) OR ("cardiac"[All Fields] AND "surgery"[All Fields])) OR "cardiac surgery"[All Fields]) OR "cardiac surgical procedures"[MeSH Terms]) OR (("cardiac"[All Fields] AND "surgical"[All Fields]) AND "procedures"[All Fields])) OR "cardiac surgical procedures"[All Fields]) OR ("cardiac"[All Fields] AND "surgery"[All Fields]))) AND ((("adult"[MeSH Terms] OR "adult"[All Fields]) OR "adults"[All Fields]) OR "adult s"[All Fields]) AND (English[lang] OR French[lang])

Supplemental Table S1. Characteristics of retrieved clinical studies in chronologic and alphabetical order

First Authors	Methodology	n	Results	Mechanism
Doohden et al. (1964)[15]	CR	1	RVOTO caused by cardiac myxoma	IM
Goldstein and Mahoney (1966)[16]	CR	1	RVOTO caused by a RV fibrosarcoma	IM
Kiser et al. (1968)[17]	CS	2	2 cases of RVOTO in patients with dextrocardia and double-outlet right ventricle	IMC
Rawls et al. (1968)[18]	CR	1	RVOTO caused by a myocardial abscess in a tuberculosis patient	IM
McLoughlin (1970)[19]	CR	1	RVOTO caused by metastatic bronchogenic carcinoma	EM
Hubbard and Neil (1971)[20]	CR	1	RVOTO caused by a myxoma of the RV	IM
Kerber et al. (1972)[21]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Merin et al. (1972)[22]	CR	1	RVOTO in a patient with infundibular pulmonary stenosis	IMC
Gordon et al. (1973)[23]	CR	1	RVOTO caused by a metastatic renal carcinoma	EM
Zager et al. (1973)[24]	CR	1	RVOTO caused by a myxoma of the RV	IM
Kleinfeld et al. (1976)[25]	CR	1	RVOTO due to subpulmonic stenosis in a patient with situs inversus totalis	IMC
Shmookler et al. (1977)[26]	CS and RS	2 9r	RVOTO caused by primary sarcoma of the pulmonary trunk In retrospective study 9/35 had primary pulmonary artery sarcoma that extended into the RVOT but not mentioned if this was a source of obstruction	IM

Griffith and Myers (1978)[27]	CR	1	RVOTO caused by metastasis of primary ovarian tumor	EM
Betancourt et al. (1979)[28]	CR	1	RVOTO caused by a schwannoma in the RVOT	IM
Birmingham and Peretz (1979)[29]	CR	1	RVOTO caused by a metastatic carcinoma from the colon	EM
Silvestre et al. (1979)[30]	CR	1	RVOTO due to an interventricular septum aneurysm	IM
Hada et al. (1980)[31]	CR	1	RVOTO caused by right ventricle myxoma blocking RVOT during systole	ID
Steffens et al. (1980)[32]	CR	1	RVOTO caused by a metastatic hepatocellular tumor	EM
Ceretto et al. (1981)[33]	CR	1	RVOTO caused by a RV mesenchymoma	IM
Upward et al. (1983)[34]	CR	1	RVOTO caused by pericardial abscess	EM
Ellis et al. (1984)[35]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Lo et al. (1984)[36]	CR	1	RVOTO caused by ectopic thyroid tissue in the heart	EM
Norell et al. (1984)[37]	CR	1	RVOTO caused by metastasis of primary colonic carcinoma	EM
Przybojewski (1984)[38]	CR	1	RVOTO caused by suspected echicococcal hydatid cyst in RV	EM
Warnes et al. (1984)[39]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Come et al. (1985)[40]	CR	1	RVOTO caused by extrinsic compression of immunoblastic sarcoma	EM
Desai et al. (1985)[41]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Nishimura et al. (1985)[42]	CR	1	RVOTO caused by constrictive pericardial disease	EM
Shemin et al. (1985)[43]	CR	1	RVOTO caused by an ectopic thyroid tumor in the heart	EM

Antonelli et al. (1986)[44]	CR	1	RVOTO caused by a hydatid cyst on the interventricular septum	EM
Hara et al. (1986)[45]	CR	1	RVOTO caused by metastatic undifferentiated thyroid tumor	EM
Kiefaber et al. (1986)[46]	CR	1	RVOTO caused by an aneurysm of the sinus of Valsalva	EM
Talley et al. (1986)[47]	CR	1	RVOTO caused by leiomyosarcoma of the posterior RVOT wall	IM
Velebit et al. (1986)[48]	CR	1	RVOTO following radiation therapy which caused fibrosis of the pericardium	EMIa
Emmot et al. (1987)[49]	CR	1	RVOTO caused by metastatic melanoma	EM
Grigg et al. (1987)[50]	CR	1	RVOTO caused by an ectopic thyroid tumor in the heart	EM
Stierle et al (1987)[51]	CS	4	RVOTO caused by hypertrophic cardiomyopathy	IMC
Bartels et al. (1988)[52]	CR	1	RVOTO caused by a metastatic liposarcoma	EM
Vallance et al. (1988)[53]	CR	1	RVOTO due to localized pericardial constriction caused by tuberculosis	IM
Israeli et al. (1989)[54]	CS	3	RVOTO caused by extracardiac tumor compression (2 due to lymphoma and 1 due to seminoma)	EM
Fremes et al. (1990)[55]	CR	1	RVOTO following a single lung transplantation	IDIa
Haraphongse et al. (1990)[56]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Kamlow et al. (1991)[57]	CR	1	RVOTO caused by a metastatic histiocytoma from the thigh	EM
Reiss et al. (1991)[58]	CR	1	RVOTO caused by a RV hemangioma	IM

Labib et al. (1992)[59]	CS	3	3 cases of RVOTO caused by metastatic adenocarcinoma, 1 from the colon, 1 from the pancreas and 1 from the breast	EM
Agrawal et al. (1993)[60]	CS	2	2 cases of RVOTO caused by an aneurysm of sinus of Valsalva	EM
Gorcsan et al. (1993)[61]	CR	1	RVOTO following lung transplantation	IDIa
Carroll et al. (1994)[62]	CR	1	RVOTO from metastatic renal cell carcinoma	EM
Ignaszewski et al. (1994)[63]	CR	1	RVOTO caused by an aneurysm of the membranous ventricular septum	IM
Mukadam et al. (1994)[64]	CR	1	RVOTO caused by a myxoma of the RV	IM
Ritchie et al. (1994)[65]	CR	1	RVOTO following a single lung transplantation	IDIa
Tardif et al. (1994)[66]	CR	1	RVOTO caused by an external compression by a post-operative mediastinal hematoma	EMIa
Kroshus et al. (1995)[67]	CS	2	2 cases of RVOTO following lung transplantation	IDIa
Calderon et al. (1996)[68]	CR	1	RVOTO caused by cardiac angiomyosarcoma of the RV	IM
Kasprzak et al. (1996)[69]	CR	1	RVOTO caused by a metastatic follicular carcinoma of the thyroid	EM
Kirshbom et al. (1996)[70]	CR	1	RVOTO after bilateral lung transplantation	IDIa
Soejima et al. (1996)[71]	CR	1	RVOTO caused by a myxoma of the RV	IM
Balkin and Imoto (1997)[72]	CR	1	RVOTO caused by soft tissue sarcoma extension from RV	IM
Henderson et al. (1997)[73]	CR	1	RVOTO caused by a neurofibroma in the RV	IM
Ng and Olak (1997)[74]	CR	1	RVOTO caused by pericardial necrotic mesothelial cyst	EM
Sebastian et al. (1997)[75]	CR	1	RVOTO caused by pseudoaneurysm of a grafted coronary artery	EMIa

Yilmaz et al. (1997)[76]	RS -File review of patients who had an aneurysm of the sinus of Valsalva -Cases between 1980 and 1994	1	1/9 of patients had a concurrent RVOTO with sinus of Valsalva aneurysm	EM
Esaki et al. (1998)[77]	CR	1	RVOTO caused by a leiomyosarcoma of the RV	IM
Sugi et al. (1998)[78]	CR	1	RVOTO caused by a compression of the RVTO from behind by the aorta following a right pneumonectomy	EMIa
Wankmuller et al. (1998)[79]	CR	1	RVOTO caused by metastasis of fibrous histiocytoma from breast	EM
Halcox, J. P. J. (1999)[80]	CR	1	RVOTO caused by non-Hodgkin lymphoma compression	EM
Marques et al. (1999)[81]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Van Camp et al. (1999)[82]	CR	1	RVOTO due to external compression by a pseudoaneurysm of an aortic graft	EMIa
Beaver et al. (2000)[83]	CR	1	RVOTO caused by primary cardiac fibrosarcoma	IM
Casanova et al. (2000)[84]	CR	1	RVOTO caused by an ectopic thyroid tissue in the RVOT	EM
Gopal et al. (2000)[85]	CR	1	RVOTO caused by a myxoma of the RV	IM
Kann et al. (2000)[86]	CR	1	RVOTO caused by a RVOT hemangioma	IM
Kono et al. (2000)[87]	CR	1	RVOTO caused by a leiomyosarcoma of the RV	IM
McElhinney et al. (2000)[88]	CS	3	RVOTO secondary to double chambered right ventricle	IMC

Murakawa et al. (2000)[89]	CR	1	RVOTO caused by metastatic hepatocellular carcinoma	EM
Zakynthinos et al (2000)[90]	CR	1	RVOTO caused by extrinsic compression by non-small cell lung carcinoma	EM
Hayashi et al. (2001)[91]	CR	1	RVOTO caused by biventricular hypertrophic cardiomyopathy	IMC
Katoh et al. (2001)[92]	CR	1	RVOTO caused by hypertrophic cardiomyopathy	IMC
Krishnamoorthy and Desai (2001)[93]	CR	1	RVOTO caused by a myxoma of the RV	IM
Willaert et al. (2001)[94]	CR	1	RVOTO caused by a leiomyosarcoma of the RV	IM
Agarwal et al. (2002)[95]	CR	1	RVOTO caused by a pulmonary artery aneurysm	EM
Doshi et al. (2002)[96]	CR	1	RVOTO due to hypertrophic cardiomyopathy	IMC
Gersak et al. (2002)[97]	CR	1	RVOTO caused by metastatic choriocarcinoma	EM
Youn et al. (2002)[98]	CR	1	RVOTO caused by extended metastasis from esophageal cancer	EM
Denault et al. (2003)[99]	CR	1	RVOTO caused by post-surgical thoracic tamponade	EMIa
Mohanakrishnan et al. (2003)[100]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Paraskevaidis et al. (2003)[101]	CR	1	RVOTO caused by a myxoma of the RV	IM
Shimizu et al. (2003)[102]	-RS -Review of Doppler evaluations of	9	9/91 patients had hypertrophic cardiomyopathy causing RVOTO	IMC

	patients with hypertrophic cardiomyopathy			
Thankachen et al. (2003)[103]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Yamada et al. (2003)[104]	CS	2	2 cases of RVOTO: one caused by a fibrous histiocytoma, one by a leiomyosarcoma	IM
Anbarasu et al. (2004)[105]	CR	1	RVOTO caused by an endomyocardial fibrosis of the RV	IM
Baweja et al. (2004)[106]	CR	1	RVOTO caused by ventricular septal aneurysm	ED
Gunes et al (2004)[107]	CR	1	RVOTO caused by large aneurysm extending from perimembranous septum to RVOT	EM
Miyaji et al. (2004)[108]	CR	1	RVOTO following lung transplantation	IDIa
Rastan et al. (2004)[109]	CR	1	RVOTO caused by a cardiac leiomyosarcoma	IM
Sharda et al. (2004)[110]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Totaro et al. (2004)[111]	CR	1	RVOTO caused by an angiosarcoma in the pulmonary trunk	EM
Brestas et al. (2005)[112]	CR	1	RVOTO caused by a myxoma of the RV	IM
Iba et al. (2005)[113]	CR	1	RVOTO caused by a cardiac hemangioma	IM
Ichinose et al. (2005)[114]	CR	1	RVOTO due to fibrous thickening of the endocardium and subendocardium 24 years after mediastinal radiotherapy for non-Hodgkin's lymphoma	IMIa
Ishikawa et al. (2005)[115]	CR	1	RVOTO caused by a primary cardiac leiomyosarcoma	IM
Karagounis and Sarsam (2005)[116]	CR	1	RVOTO caused by a myxoma of the RV	IM

Prabhakar et al. (2005)[117]	CR	1	RVOTO due to thrombus formed in the RV of a patient with antiphospholipid syndrome	IM
Atik et al. (2006)[118]	CR	1	RVOTO caused by a metastatic renal cell carcinoma	EM
Bhavani et al. (2006)[119]	CR	1	RVOTO caused by an endocarditis of the pulmonary valve following an infection of the sternal suture	EMIa
Chiu et al. (2006)[120]	CS	2	2 cases of RVOTO following heterotopic heart transplantation: caused by a stenosis of the pulmonary artery conduit	EMIa
Daccarett et al. (2006)[121]	CR	1	RVOTO caused by a pulmonary valve fibroelastoma	IM
Denault et al. (2006)[122]	RS & PS -File review of patients who had a TEE -Cohort between 2002 and 2004 -Prospective confirmatory cohort between 2004 and 2005	6r 5p	-6/670 in the retrospective group had a RVOTO -5/130 in the prospective group had a RVOTO	IDIa
Kholeif et al. (2006)[123]	CR	1	RVOTO caused by an aneurysm of the main pulmonary artery	EM
May et al. (2006)[124]	CR	1	RVOTO caused by metastatic yolk sac tumor	EM
Rosenberger et al. (2006)[125]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM

Bouzas-Mosquera et al. (2007)[126]	CR	1	RVOTO caused by a rhabdomyosarcoma	IM
Gelfand et al. (2007)[127]	CR	1	RVOTO caused by sinus of Valsalva aneurysm	EM
Krecki et al (2007)[128]	CR	1	RVOTO caused by hypertrophic cardiomyopathy	IMC
Murakami et al. (2007)[129]	CR	1	RVOTO caused by metastasis of transitional cell carcinoma	EM
Ozbek et al. (2007)[130]	CR	1	RVOTO caused by sarcoma of the pulmonary artery with extension to the pulmonic valve and RV	IM
Sayin et al. (2007)[131]	CR	1	RVOTO caused by a RV myxoma	IM
Aktoz et al. (2008)[132]	CR	1	RVOTO caused by a cardiac rhabdomyoma	IM
Butz et al. (2008)[133]	CR	1	RVOTO caused by a biventricular hypertrophic cardiomyopathy	IMC
Coskun et al. (2008)[134]	CS	1	RVOTO in a patient with recently repaired tetralogy of Fallot: high grade pulmonary valve stenosis and insufficiency	EDIa
Goksel et al. (2008)[135]	CR	1	RVOTO caused by a RVOT aneurysm	IM
Nishida et al. (2008)[136]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Omura et al. (2008)[137]	CR	1	RVOTO caused by a sarcoma of the pulmonary artery	EM
Rigatelli et al. (2008)[138]	CR	1	RVOTO post Konno procedure (autograft of the aortic valve and dilation of the RVOT)	EMIa
Yang et al. (2008)[139]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Agarwal et al. (2009)[140]	CR	1	RVOTO caused by a hydatid cyst in the RVOT	EM
Bijulal et al.(2009)[141]	CR	1	RVOTO caused by membranous septal aneurysm in a patient with a double outlet RV	IM

Chen et al. (2009)[142]	CR	1	RVOTO after bilateral lung transplantation	IDIa
Chue et al. (2009)[143]	CR	1	RVOTO due to compression by an infected thrombus during pregnancy following Rastelli procedure*	IMIa
Farand et al. (2009)[144]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Lee et al. (2009)[145]	CR	1	RVOTO caused by primary pleomorphic leiomyosarcoma of the RV	IM
Martin et al. (2009)[146]	CR	1	RVOTO due to infundibular pulmonary stenosis secondary to hypertrophied muscle bundles	IMC
Ozer et al. (2009)[147]	CR	1	RVOTO due to external compression by a mediastinal nodular sclerosing Hodgkin's lymphoma	EM
Avci et al. (2010)[148]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Ivanovic et al. (2010)[149]	CR	1	RVOTO caused by a cardiac myxoma	IM
Khouzam et al. (2010)[150]	CR	1	RVOTO caused by a thrombus formed in the RVOT of a patient with Ebstein's malformation and tricuspid stenosis	IMC
Lee et al. (2010)[151]	CR	1	RVOTO caused by an accessory tricuspid valve	IMC
Recupero et al. (2009)[152]	CR	1	RVOTO caused by hypertrophic cardiomyopathy	IMC
Rosu et al. (2010)[153]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Takigawa et al. (2010)[154]	CR	1	RVOTO caused by congenital infundibular pulmonary stenosis	IMC
Vida et al. (2010)[155]	CR	1	RVOTO caused by a stenotic RVOT homograft	IMIa
Chaudhry et al. (2011)[156]	CR	1	RVOTO caused by metastatic B-cell lymphoma of the thymus	EM

Chen et al. (2011)[157]	CR	1	RVOTO secondary to membranous ventricular septal aneurysm	IM
Darwazah et al. (2011)[158]	CS	2	2 cases of RVOTO caused by an adult presentation of double-chambered RV	IMC
Gajjar et al. (2011)[159]	CR	1	RVOTO caused by a ventricular myxoma	IM
Garg et al. (2011)[160]	CR	1	RVOTO caused by a cardiac metastasis of a phyllodes tumor	EM
Shah et al. (2011)[161]	CR	1	RVOTO caused by pulmonary intimal sarcoma	EM
Tsang and Cheng (2011)[162]	CR	1	RVOTO caused by a myxoma of the tricuspid valve	IM
Gil-Jaurena et al. (2012)[163]	CS	2	2 cases of RVOTO in adults with uncorrected tetralogy of Fallot	IMC
Guo et al. (2012)[164]	-RS -File review of patients undergoing surgery for correction of sinus of Valsalva aneurysm	11	11/222 patients had pre-operative RVOTO, with 2 caused by double chambered right ventricle and 9 caused by abnormal hypertrophic muscle band, concomitantly existing with sinus of Valsalva aneurysm 2 patients were excluded from total of 13 due to being less than 18 years old	IMC
Matsushita et al. (2012)[165]	CR	1	RVOTO by a medical patch in the RV	IMIa
Obert et al. (2012)[166]	CR	1	RVOTO caused by fibrous band compressing the anterior wall of the RA and RV following Nuss procedure*	EMIa

Pemberton and Raudkivi (2012)[167]	CR	1	RVOTO caused by a myxoma of the RV	IM
Rao et al. (2012)[168]	CR	1	RVOTO caused by an accessory tissue of the mitral valve in a patient with double outlet right ventricle	IMC
Sogawa et al. (2012)[169]	CR	1	RVOTO caused by a cardiac hemangioma	IM
Tamenishi et al. (2012)[170]	CR	1	RVOTO caused by a fibrous histiocytoma originating from the RVOT	IM
Tsubota and Nakamura (2012)[171]	CR	1	RVOTO caused by a non-correction of a tetralogy of Fallot at the adult age	IMC
Yagoub et al. (2012)[172]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Altunbas et al. (2013)[173]	CR	1	RVOTO caused by a giant aneurysm of a membranous VSD	IM
Antonetti et al. (2013)[174]	CR	1	RVOTO in a patient with unrepaired tetralogy of Fallot	IMC
Bhat et al. (2013)[175]	CR	1	RVOTO caused by an endocarditis of a prosthetic pulmonary valve	EMIa
Brown et al. (2013)[176]	CR	1	RVOTO caused by a cardiac angioma	IM
Dryzek et al. (2013)[177]	CR	1	RVOTO caused by a giant pseudoaneurysm of the RVOT	IM
Fontana et al. (2013)[178]	CR	1	RVOTO caused by metastasis of malignant melanoma causing partial obstruction	EM
Gavali et al. (2013)[179]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Minagawa et al. (2013)[180]	CR	1	RVOTO caused by unruptured sinus of Valsalva aneurysm	EM
Mohsen et al. (2013)[181]	CR	1	RVOTO caused by a double-chambered RV	IMC
Obrenovic-Kircanski et al. (2013)[182]	CR	1	RVOTO caused by a myxoma of the RV	IM

Sah et al. (2013)[183]	CR	1	RVOTO caused by a pseudoaneurysm of a surgically reconstructed RVOT	IMIa
Yousif et al. (2013)[184]	CR	1	RVOTO caused by a congenital subpulmonic fibrous ring	EMC
Zanotti et al. (2013)[185]	CR	1	RVOTO caused by left and main pulmonary artery aneurysm in the setting of lung transplantation and pulmonary stenosis surgery	EM
Bang et al. (2014)[186]	CR	1	RVOTO caused by a cardiac trichinellosis	EM
Bruckner et al. (2014)[187]	CR	1	RVOTO caused by a metastatic cardiac sarcoma from the thigh	EM
Chen et al. (2014)[188]	CR	1	RVOTO caused by a myxoma of the RVOT	IM
Cheng et al. (2014)[189]	CR	1	RVOTO due to a ventricular septal defect missed during surgery	IMIa
Kokotsakis et al. (2014)[190]	CR	1	RVOTO caused by a double-chambered RV	IMC
Le et al. (2014)[191]	CR	1	RVOTO caused by giant sinus of Valsalva aneurysm	EM
Madeo et al. (2014)[192]	CR	1	RVOTO caused by sinus of Valsalva aneurysm	EM
Malik et al (2014)[193]	CR	1	RVOTO caused by hypertrophic cardiomyopathy	IMC
Patel et al. (2014)[194]	CS	1	RVOTO caused by a sinus of Valsalva aneurysm Note that there are 2 cases of sinus of Valsalva aneurysm in this case series, but only 1 of them causes RVOTO	EM
Ramakrishnan et al. (2014)[195]	CR	1	RVOTO following elective pulmonary valve balloon dilation	IMIa
Song et al. (2014)[196]	CR	1	RVOTO caused by a leiomyoma of the RV	IM

Urban et al. (2014)[197]	CR	1	RVOTO caused by an ectopic thyroid tissue in the RVOT	EM
Yam and Au (2014)[198]	CR	1	RVOTO caused by a cardiac hemangioma	IM
Buys et al. (2015)[199]	CS	1	RVOTO post correction of a double outlet RV Represents a case series of 3 cases of RVOTO post double outlet right ventricle, however only one case was in an adult patient	IMC
Chaudhry-Waterman et al. (2015)[200]	CS	2	2 cases of RVOTO caused by an endocarditis of implanted pulmonary valves	EMIa
Das et al. (2015)[201]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Mahesh et al. (2015)[202]	CR	1	RVOTO caused by a membranous septal aneurysm	IM
Mohan and Mohan (2015)[203]	CR	1	RVOTO caused by double chambered right ventricle	IMC
Mori et al. (2015)[204]	CR	1	RVOTO caused by a failure of RV-PA conduit	IMIa
Moustafa et al. (2015)[205]	CS	2	RVOTO caused by double chambered right ventricle muscle bundles during systole	IDC
Omar et al. (2015)[206]	CR	1	RVOTO caused by a metastatic carcinoid tumor to the heart	EM
Osada et al. (2015)[207]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Rier et al. (2015)[208]	CR	1	RVOTO due to external compression by an aortocoronary saphenous vein graft aneurysm	EMIa
Singhal et al. (2015)[10]	CR	1	RVOTO caused by severe valvular and subvalvular stenosis followed by cardiac catheterization resulting in dynamic RVOT obstruction	EDIa

Sridhar et al. (2015)[209]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Torres et al. (2015)[210]	CS	2	2 cases of RVOTO caused by an aorto-pulmonary communication after the placement of a RVOT conduit	EMIa
Wang et al. (2015)[211]	CR	1	RVOTO caused by a primary RV intramyocardial lipoma	IM
Abu Saleh et al. (2016)[212]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Caldeira et al. (2016)[213]	CR	1	RVOTO caused by a metastatic myocardial neuroendocrine tumor of gastrointestinal origin	EM
Demirel et al. (2016)[214]	CR	1	RVOTO caused by double chambered right ventricle	IMC
Higashi et al. (2016)[215]	CR	1	RVOTO caused by pleomorphic sarcoma in the RVOT	IM
Kim et al. (2016)[216]	CR	1	RVOTO most likely due to metastatic renal cell carcinoma	EM
Musuku et al. (2016)[217]	CR	1	RVOTO in a double outlet RV	IMC
Naqvi et al. (2016)[218]	CR	1	RVOTO caused by a neuroendocrine tumor of the RV	IM
Rao et al. (2016)[219]	CR	1	RVOTO caused by myxoma protruding through pulmonic valve during systole	ID
Schneider et al. (2016)[220]	CS	2	2 cases of RVOTO caused by non-infective thrombosis of implanted pulmonary valve	EMIa
Singh et al. (2016)[221]	CR	1	RVOTO caused by a hydatid cyst in the RVOT	EM
Zhang et al. (2016)[222]	CR	1	RVOTO caused by a lipoma	IM
Antoniucci et al. (2017)[223]	CR	1	RVOTO during anesthesia induction for a surgical coronary revascularisation	IDIa
Joseph et al (2017)[224]	CR	1	RVOTO caused by metastatic sarcomatoid carcinoma	EM
Manmadhan et al. (2017)[225]	CR	1	RVOTO due to pulmonary artery intimal spindle cell sarcoma	EM

Padilla-Ibarra et al. (2017)[226]	CR	1	RVOTO caused by soft tissue sarcoma in the RVOT	IM
Privitera et al. (2017)[227]	CR	1	RVOTO caused by malaligned VSD and presence of perimembranous septal mobile aneurysm protruding in RV during systole	ID
Unosawa et al. (2017)[228]	CR	1	RVOTO caused by a double-chambered RV	IMC
Verhoeven et al. (2017)[229]	CR	1	RVOTO due to thrombosis of an implanted pulmonary valve	EMIa
Young et al. (2017)[230]	CR	1	RVOTO caused by a hemangioma of the interventricular septum	IM
Gangahanumaiah et al. (2018)[231]	CR	1	RVOTO following VSD closure and bilateral lung transplantation due to right ventricular hypertrophy	EMIa
Gendera et al. (2018)[232]	CR	1	RVOTO caused by a prosthetic pulmonary valve stuck in the pulmonary artery during its delivery	EMIa
Isom et al. (2018)[233]	CR	1	RVOTO caused by a cardiac metastasis of a yolk sac tumor	EM
Karabag et al. (2018)[234]	CR	1	RVOTO caused by a metastatic adenocarcinoma	EM
Kellermair et al. (2018)[235]	CR	1	RVOTO caused by thrombosis of implanted pulmonary valve	EMIa
Kocabas et al. (2018)[236]	CR	1	RVOTO due to a sinus of Valsalva aneurysm	EM
Tomar and Bhan (2018)[237]	CS	1	RVOTO caused by pseudoaneurysm as a complication of RVOT reconstruction The case series features 2 cases, however one case was rejected since it was pediatric	IMIa
Zheng et al. (2018)[238]	CR	1	RVOTO caused by a myxoma	IM

Akikwala et al. (2019)[239]	CR	1	RVOTO caused by a hemangioma of the pulmonary artery	EM
Briosa E. G. A. et al. (2019)[240]	CR	1	RVOTO caused by renal cell carcinoma metastasis	EM
Mohan et al. (2019)[241]	CR	1	RVOTO caused by hypertrophic cardiomyopathy	IMC
Munirathinam et al. (2019)[242]	CR	1	RVOTO following aortic valve replacement and pulmonary valvotomy	IDIa
Ramnath et al. (2019)[243]	CR	1	RVOTO due to narrowing of the pulmonary valve by a suture of the mechanical aortic valve	EMIa
Serban et al. (2019)[244]	CR	1	RVOTO caused by a sinus of Valsalva aneurysm	EM
Zhu et al. (2019)[245]	CR	1	RVOTO caused by double chambered right ventricle in a patient with VSD	IMC
Zivkonic et al. (2019)[246]	CR	1	RVOTO caused by a calcified amorphous tumor in the RV	IM

C, congenital; CR, case report; CS, case series; D, dynamic; E, extrinsic; HCM, hypertrophic cardiomyopathy; I, intrinsic; Ia, iatrogenic; M, mechanical; n, number; NA, not applicable; p, prospective group; PA, pulmonary artery; PS, prospective study; r, retrospective group; RS, retrospective study; RV, right ventricle; RVOT, right ventricular outflow tract; RVOTO, right ventricular outflow tract obstruction; VSD, ventricular septal defect; *Rastelli procedure: relieves pulmonary obstruction in double outlet right ventricle with pulmonary stenosis by using a pulmonary or aortic homograft conduit; *Nuss procedure: minimally invasive correction of pectus excavatum.

Supplemental Table S2. Prevalence of RVOTO by detailed etiology (n=291)

Extrinsic Mechanical Non-Iatrogenic Non-Congenital	94
Intrinsic Mechanical Non-Iatrogenic Non-Congenital	76
Intrinsic Mechanical Congenital	58
Extrinsic Mechanical Iatrogenic	24
Intrinsic Dynamic Iatrogenic	21
Intrinsic Mechanical Iatrogenic	9
Extrinsic Dynamic Iatrogenic	2
Intrinsic Dynamic Non-Iatrogenic Non-Congenital	3
Intrinsic Dynamic Congenital	2
Extrinsic Mechanical Congenital	1
Extrinsic Dynamic Non-Iatrogenic Non-Congenital	1
Extrinsic Dynamic Congenital	0

Supplemental Table S3. Underlying pathology in non-congenital and non-iatrogenic reported cases of RVOTO (n=174)

Primary cardiac tumors (n=71)		Extra-cardiac tumors (n=40)		Other causes (n=63)	Number of reported cases
Pathology	Number of reporter cases	Metastasis origin	Number of reporter cases		
Myxoma 15, 20, 24, 31, 64, 71, 85, 93, 101, 112, 116, 131, 149, 159, 162, 167, 182, 188, 219, 238	20	Renal cell carcinoma 23,62, 118,216,240	5	Sinus of Valsalva aneurysm 21, 35, 39, 41, 46, 56, 60(2),76, 81, 100, 103, 110, 125, 127, 136,139,144, 148, 153,172,179,180, 191, 192, 194, 201, 207, 209, 212, 236, 244	32
Pulmonary artery/trunk neoplasm 26(11),104(2),111,130, 137, 161,225	18	Compression by lymphoma[54(2),80, 147]	4	Septal aneurysm 30,63, 106, 107, 141, 157,202,227	8
Leiomyosarcoma 47,77,87, 94, 109, 115, 145	7	Carcinoma of the colon[29,37, 59]	3	Ectopic thyroid tissue in RV 36, 43, 50,84,197	5
Hemangioma 58, 86, 113, 169, 198,230	6	Sarcoma[40, 187, 224]	3	Hydatid cyst[38,44, 140,221]	4
Sarcoma 72,215,226	3	Hepatocellular tumor[32, 89]	2	Pulmonary artery aneurysm[95,123,185]	3
Fibrosarcoma[16, 83]	2	Histiocytoma[57,79]	2	Other 18, 34, 42, 53, 74, 105, 117, 135, 173, 177, 186	11
Lipoma[211,222]	2	Lung cancer[90, 234]	2		
Other 28, 33, 68, 73, 121, 126, 132, 170, 176, 196, 218, 239, 246	13	Melanoma[49,178]	2		

		Metastatic thyroid tumor[45,69]	2		
		Yolk sac tumor[124, 233]	2		
		Other 19, 27, 52, 54, 59(2,) 97, 98, 129, 156, 160, 206, 213	13		

RVOTO, right ventricular outflow tract obstruction; GI, gastrointestinal; n, number; RV, right ventricle.

Supplemental Table S4. Congenital reported cases of RVOTO (n=61)

Etiology	Cases
Hypertrophic cardiomyopathy [51(4),91, 92, 96, 102(9),128, 133,152, 164(9),193, 241]	30
Double-chambered right ventricle [88(3), 158(2),164(2),181,190,203, 205(2),214,228,245]	15
Double outlet right ventricle[17(2),168, 199,217]	5
Infundibular pulmonary stenosis[22, 146, 154, 171]	4
Uncorrected tetralogy of Fallot[163(2),174]	3
Other[25, 150, 151, 184]	4

n, number; RVOTO, right ventricular outflow tract obstruction.

Supplemental Table S5. Iatrogenic reported cases of RVOTO (n=56)

Etiology	Incidence
Dynamic systolic obliteration associated with vasoactive/ionotropic agent use during surgery[122(11)]	11
Post-lung transplantation obstruction[55,61,65,67(2),70, 108, 142,231]	9
Endocarditis[119,175,200(2)]	4
Thrombosis of implanted pulmonary valve[220(2),229,235]	4
Aorto-pulmonary communication[210(2)]	2
Pseudoaneurysm following RVOT reconstruction[183,237]	2
RV thickening following radiotherapy[48,114]	2
Stenosis of grafted pulmonary artery conduit[120(2)]	2
Anesthesia induction for CABG[223]	1
Compression by the aorta post-pneumonectomy[78]	1
Compression by post-operative mediastinal hematoma[66]	1
Compression by pseudoaneurysm of aortic graft[82]	1
Compression by pseudoaneurysm of grafted coronary artery[75]	1
Compression by saphenous vein graft aneurysm[208]	1
Fibrous band compression of right heart following Nuss procedure[166]	1
Implanted pulmonary valve stenosis and/or insufficiency[134]	1
Infected thrombus compression of RVOT during pregnancy following Rastelli procedure*[143]	1

Konno procedure* failure[138]	1
Narrowing of pulmonary valve by suture[243]	1
Obstruction by a displaced medical patch[165]	1
Obstruction due to cardiac catheterization[10]	1
Obstruction following pulmonary valve balloon dilation[195]	1
Obstruction post-aortic valve replacement and pulmonary valvotomy[242]	1
Post-surgical thoracic tamponade[99]	1
Pulmonary valve graft stuck during its implantation[232]	1
RV-PA conduit obstruction[204]	1
RVOT homograft failure[155]	1
VSD missed during surgery[189]	1

CABG, coronary artery bypass graft; n, number; PA, pulmonary artery; RV, right ventricle; RVOT, right ventricular outflow tract; VSD, ventricular septal defect; *Rastelli procedure, relieves pulmonary obstruction in double outlet right ventricle with pulmonary stenosis by using a pulmonary or aortic homograft conduit; *Konno procedure, aortic valve autograft and RVOT dilatation; *Nuss procedure, minimally invasive surgical correction of pectus excavatum.

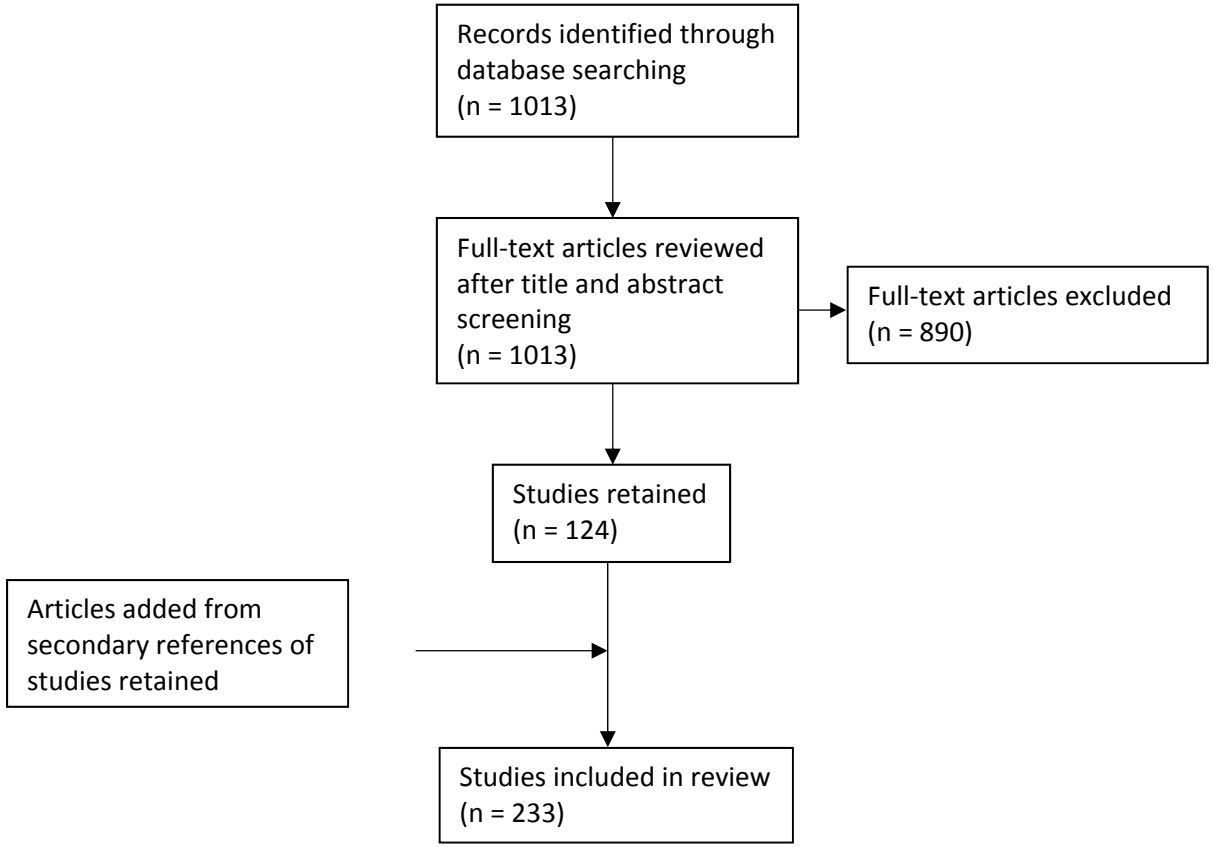
Supplemental Table S6. Reported prevalence of RVOTO

Population studied/etiology	n	Prevalence
Studies with high risk patients		
Patients with a diagnosed sinus of Valsalva aneurysm[76]	9	1/9 (11.1%)
Patients with hypertrophic cardiomyopathy[102]	91	9/91 (9.9%)
Patients with double-chambered right ventricle or abnormal hypertrophic right ventricle muscle bundle before undergoing correction of sinus of Valsalva aneurysm[164]	222	11/222 (5.0%)
Studies with unselected cardiac surgery patients		
Patients undergoing TEE[122]	670*	6/670 (0.90%)*
	130**	5/130 (3.8%)**

n: number; TEE: transesophageal echocardiography.

*retrospective group; **prospective group.

Supplemental Figure S1. Flow diagram result of the search strategy



Supplemental Appendix S2. Quality Assessment Tool for Observational Cohorts and Cross-Sectional Studies

Yilmaz AT, Demirkilic U, Ozal E, Tatar H, Ozturk OY. Aneurysms of the sinus of Valsalva. *J Cardiovasc Surg (Torino).* 1997;38:119-124.

Criteria	Yes	No	Other (CD, NR, NA)*
1. Was the research question or objective in this paper clearly stated?	X		
2. Was the study population clearly specified and defined?	X		
3. Was the participation rate of eligible persons at least 50%?			NA
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		

Criteria	Yes	No	Other (CD, NR, NA)*
5. Was a sample size justification, power description, or variance and effect estimates provided?		X	
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?			NA
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?			NA
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?			NA
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?			NA

Criteria	Yes	No	Other (CD, NR, NA)*
10. Was the exposure(s) assessed more than once over time?			NA
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
12. Were the outcome assessors blinded to the exposure status of participants?			NA
13. Was loss to follow-up after baseline 20% or less?	X		
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?			NA

Quality Rating (Good, Fair, or Poor)
Rater #1 (AC): Good
Rater #2 (AD): Good
Additional Comments (If POOR, please state why):

Shimizu M, Kawai H, Yokota Y, Yokoyama M. Echocardiographic assessment of right ventricular obstruction in hypertrophic cardiomyopathy. *Circ J.* 2003;67:855-860.

Criteria	Yes	No	Other (CD, NR, NA)*
1. Was the research question or objective in this paper clearly stated?	X		
2. Was the study population clearly specified and defined?		X	
3. Was the participation rate of eligible persons at least 50%?			NA
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X (inclusion and exclusion criteria applied)		NR (population not reported)
5. Was a sample size justification, power description, or variance and effect estimates provided?		X	

Criteria	Yes	No	Other (CD, NR, NA)*
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?			NA
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?			NA
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?			NA
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?			NA
10. Was the exposure(s) assessed more than once over time?			NA

Criteria	Yes	No	Other (CD, NR, NA)*
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
12. Were the outcome assessors blinded to the exposure status of participants?			NA
13. Was loss to follow-up after baseline 20% or less?			NA
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?			NA

Quality Rating (Good, Fair, or Poor)
Rater #1 (AC): Poor
Rater #2 (AD): Poor
Additional Comments (If POOR, please state why): Study population from which sample was taken is poorly defined (no time period, no region or location). No estimates of power provided. Most criteria not met.

*CD, cannot determine; NA, not applicable; NR, not reported.

Guo HW, Xiong H, Xu JP, Wang XQ, Hu SS. Surgical correction for sinus of valsalva aneurysm with right ventricular outflow tract stenosis. *J Card Surg.* 2012;27:99-102.

Criteria	Yes	No	Other (CD, NR, NA)*
1. Was the research question or objective in this paper clearly stated?	X		
2. Was the study population clearly specified and defined?	X		
3. Was the participation rate of eligible persons at least 50%?			NA
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
5. Was a sample size justification, power description, or variance and effect estimates provided?		X	

Criteria	Yes	No	Other (CD, NR, NA)*
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?			NA
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?			NA
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?			NA
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?			NA
10. Was the exposure(s) assessed more than once over time?			NA

Criteria	Yes	No	Other (CD, NR, NA)*
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
12. Were the outcome assessors blinded to the exposure status of participants?			NA
13. Was loss to follow-up after baseline 20% or less?	X		
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?			NA

Quality Rating (Good, Fair, or Poor)
Rater #1 (AC): Good
Rater #2 (AD): Good
Additional Comments (If POOR, please state why):

*CD, cannot determine; NA, not applicable; NR, not reported.

Denault AY, Chaput M, Couture P, Hebert Y, Haddad F, Tardif JC. Dynamic right ventricular outflow tract obstruction in cardiac surgery. *J Thorac Cardiovasc Surg.* 2006;132:43-49.

Criteria	Yes	No	Other (CD, NR, NA)*
1. Was the research question or objective in this paper clearly stated?	X		
2. Was the study population clearly specified and defined?	X		
3. Was the participation rate of eligible persons at least 50%?			NR
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
5. Was a sample size justification, power description, or variance and effect estimates provided?		X	

Criteria	Yes	No	Other (CD, NR, NA)*
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?			NA
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?			NA
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?			NA
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?			NA
10. Was the exposure(s) assessed more than once over time?			NA

Criteria	Yes	No	Other (CD, NR, NA)*
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
12. Were the outcome assessors blinded to the exposure status of participants?			NA
13. Was loss to follow-up after baseline 20% or less?	X		
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?			NA

Quality Rating (Good, Fair, or Poor)
Rater #1 (AC): Good
Rater #2 (AD): Good
Additional Comments (If POOR, please state why):

*CD, cannot determine; NA, not applicable; NR, not reported.

MOOSE (Meta-analyses Of Observational Studies in Epidemiology) Checklist

A reporting checklist for Authors, Editors, and Reviewers of Meta-analyses of Observational Studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Reporting Criteria	Reported (Yes/No)	Reported on Page No.
Reporting of Background		
Problem definition	Yes	4
Hypothesis statement	No	
Description of Study Outcome(s)	Yes	4
Type of exposure or intervention used	Yes	4
Type of study design used	Yes	4
Study population	Yes	4
Reporting of Search Strategy		
Qualifications of searchers (eg, librarians and investigators)	Yes	4-4
Search strategy, including time period included in the synthesis and keywords	Yes	5, Suppl. Mat.
Effort to include all available studies, including contact with authors	Yes	5
Databases and registries searched	Yes	5, Suppl. Mat.
Search software used, name and version, including special features used (eg, explosion)	Yes	6
Use of hand searching (eg, reference lists of obtained articles)	Yes	5
List of citations located and those excluded, including justification	Yes	5

Method for addressing articles published in languages other than English	Yes	4
Method of handling abstracts and unpublished studies	Yes	4
Description of any contact with authors	No	
Reporting of Methods		
Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	Yes	4
Rationale for the selection and coding of data (eg, sound clinical principles or convenience)	No	
Documentation of how data were classified and coded (eg, multiple raters, blinding, and interrater reliability)	Yes	5-6
Assessment of confounding (eg, comparability of cases and controls in studies where appropriate	No	

Reporting Criteria	**Reported (Yes/No)**	**Reported on Page No.**
Assessment of study quality, including blinding of quality assessors; stratification or regression on possible predictors of study results	Yes	6
Assessment of heterogeneity	Yes	6

Description of statistical methods (eg, complete description of fixed or random effects models, justification of whether the chosen models account for predictors of study results, dose-response models, or cumulative meta-analysis) in sufficient detail to be replicated	Yes	6
Provision of appropriate tables and graphics	Yes	9
Reporting of Results		
Table giving descriptive information for each study included	Yes	Suppl. Mat.
Results of sensitivity testing (eg, subgroup analysis)	Yes	6
Indication of statistical uncertainty of findings	Yes	6
Reporting of Discussion		
Quantitative assessment of bias (eg, publication bias)	Yes	12
Justification for exclusion (eg, exclusion of non–English-language citations)	Yes	6
Assessment of quality of included studies	Yes	10
Reporting of Conclusions		
Consideration of alternative explanations for observed results	Yes	12
Generalization of the conclusions (ie, appropriate for the data presented and within the domain of the literature review)	Yes	12-13
Guidelines for future research	Yes	13
Disclosure of funding source	No	

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