

# Chirurgia Mitralica mininvasiva: visione diretta, endoscopica o robotica?

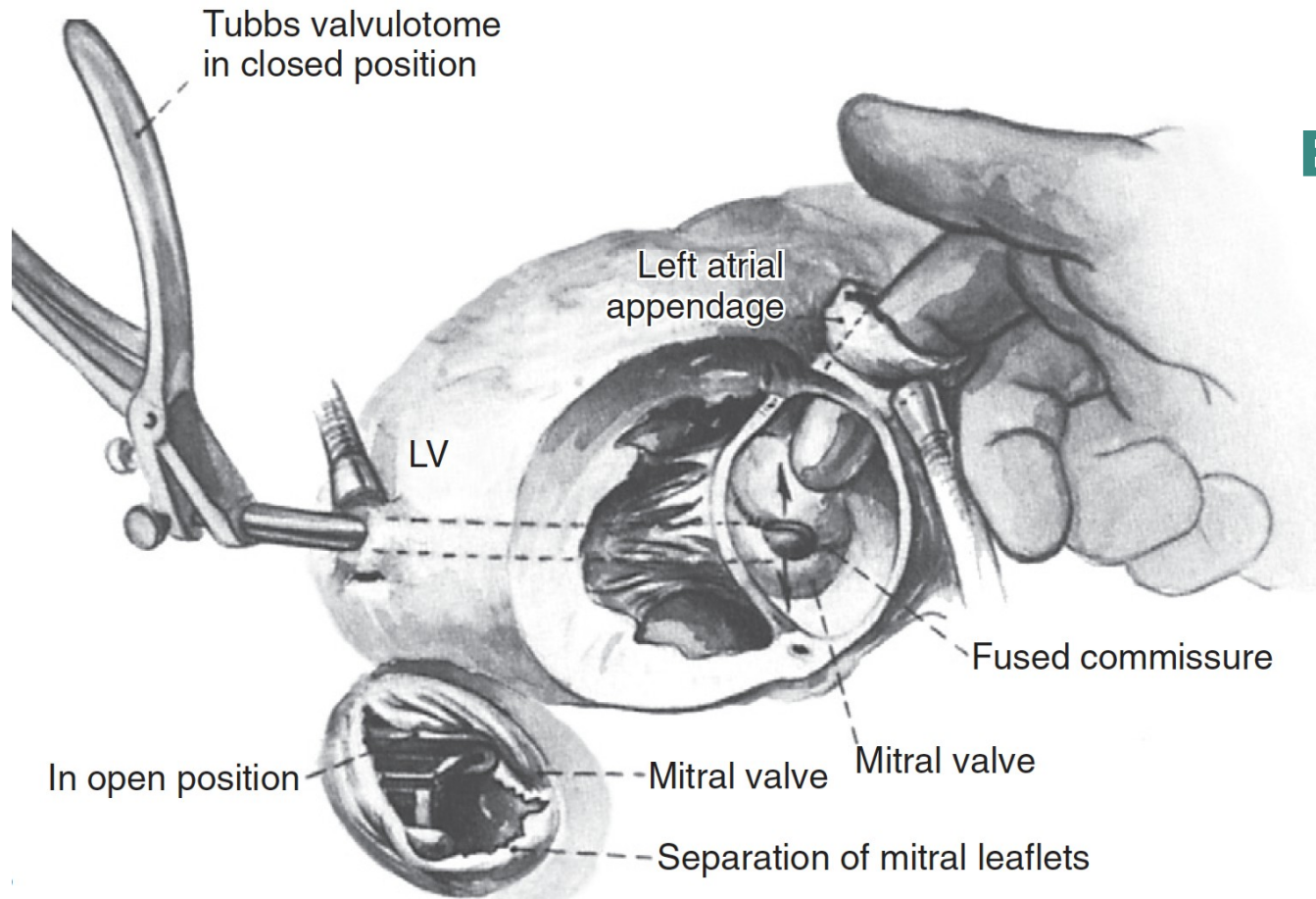
**HOT TOPICS  
IN CARDIOLOGIA  
2023**

**13 e 14 Novembre 2023**

Villa Doria D'Angri - Via F. Petrarca 80,  
Napoli

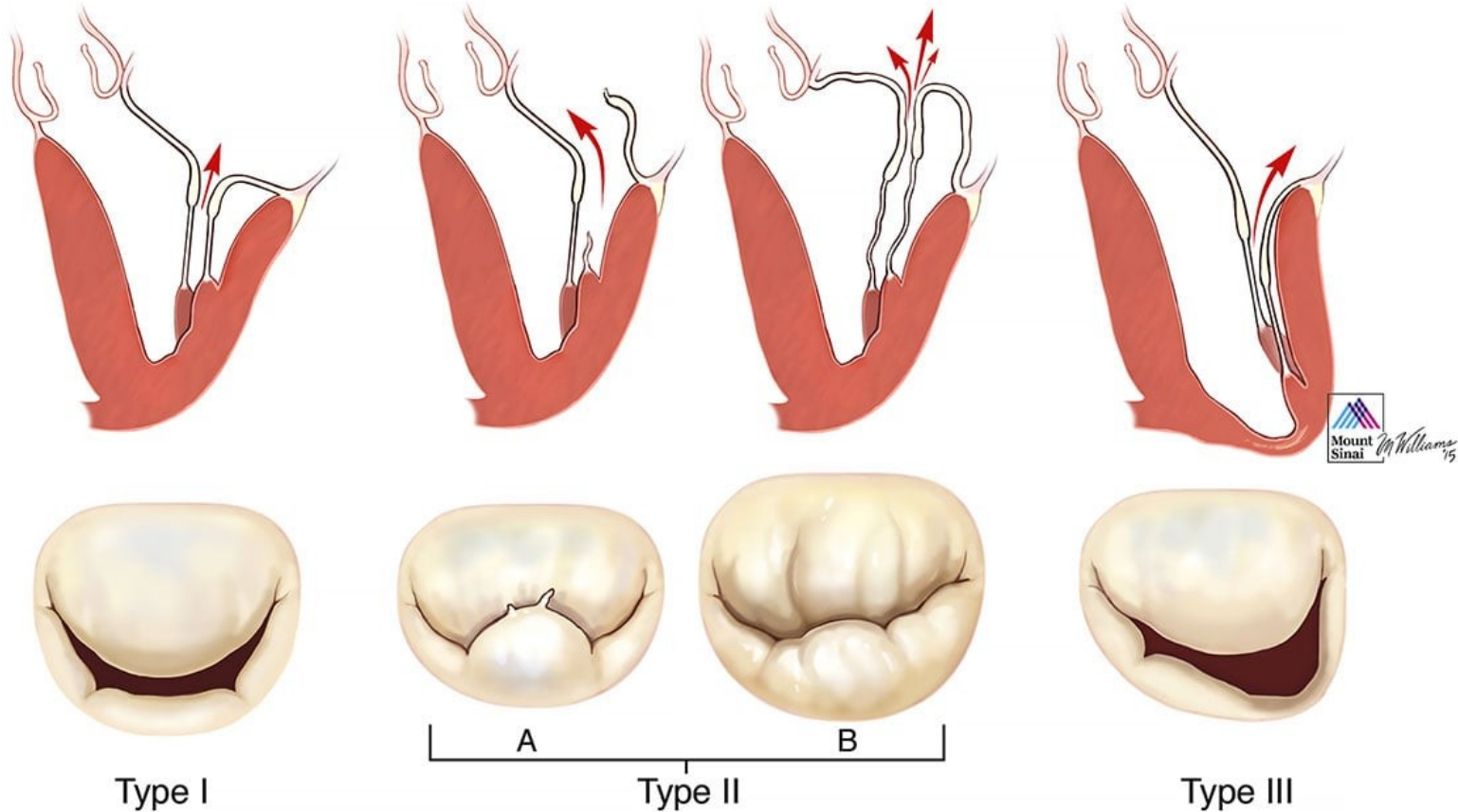
**Emanuele Pilato, MD**

# Where did we come from?



Ellis FH, 1967

# Carpentier's Classification



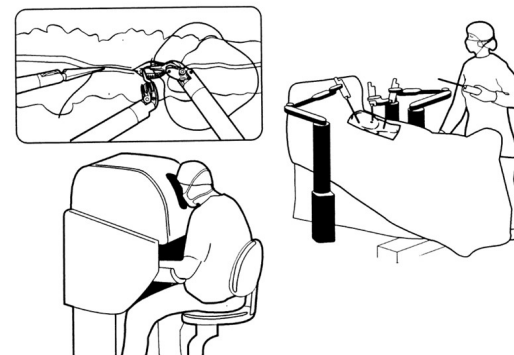
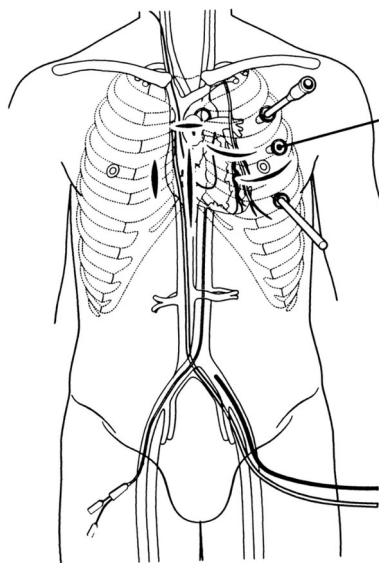
Honored Guest Lecture

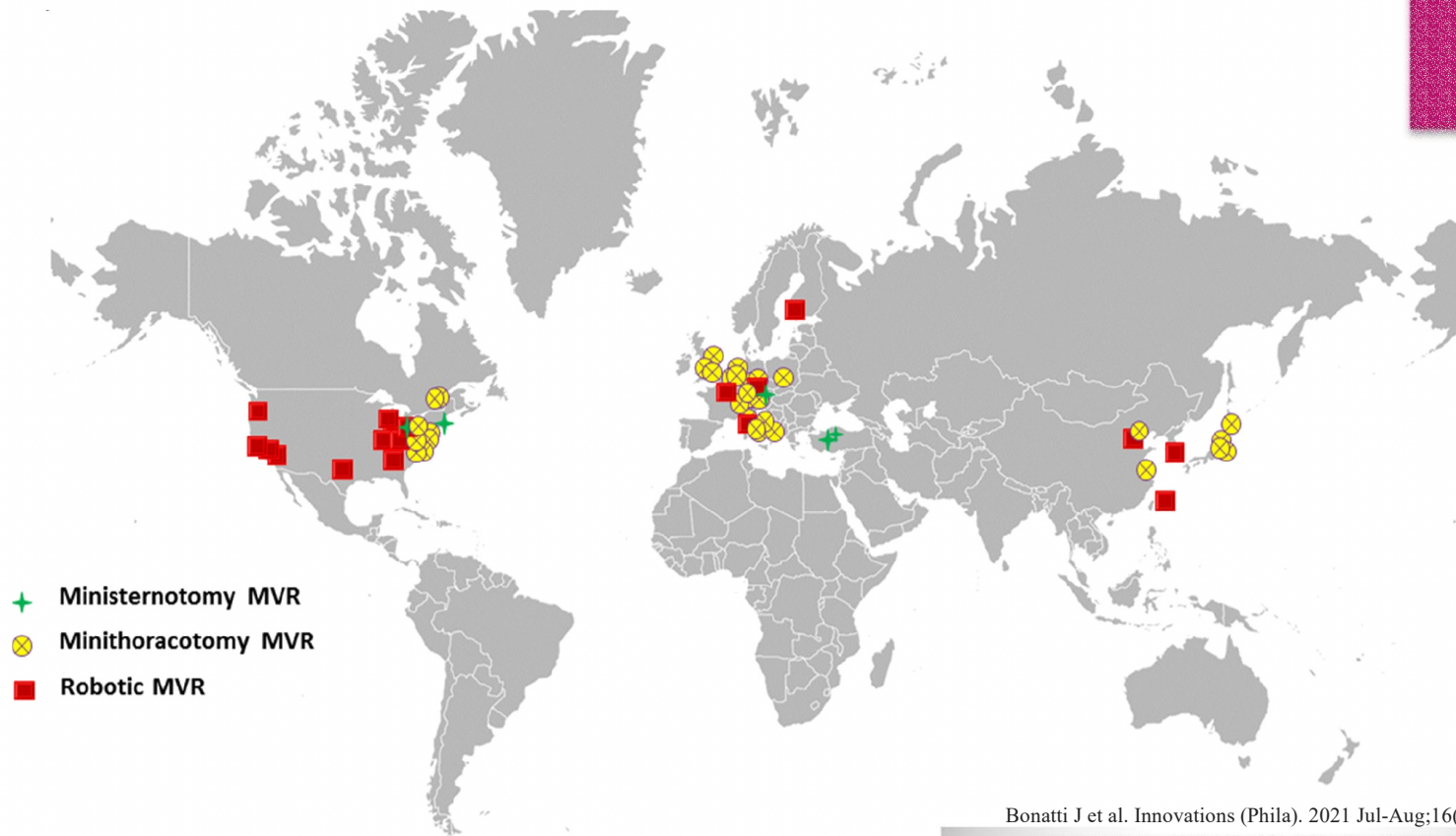
# Coronary artery surgery: the end of the beginning<sup>☆</sup>

Floyd D. Loop<sup>\*</sup>

*The Cleveland Clinic Foundation, 9500 Euclid Avenue, Cleveland, OH 44195, USA*

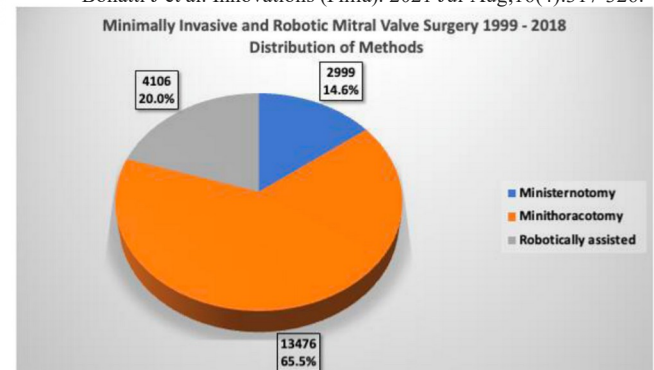
Received 28 September 1998; accepted 30 September 1998





**From 1999 to 2019:**  
**50 papers about MV**  
**Repair/replacement**  
**20,539 patients**

Bonatti J et al. Innovations (Phila). 2021 Jul-Aug;16(4):317-326.

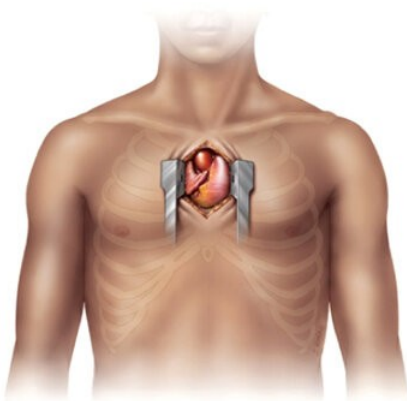


# Ministernotomy Approach

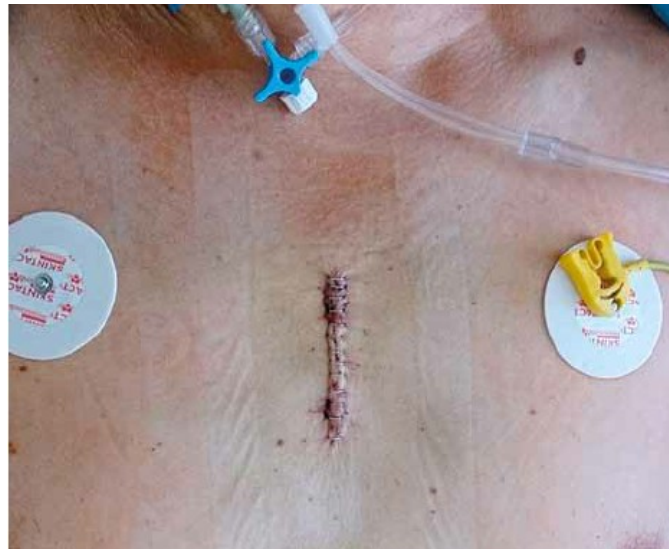
**Table I.** Mitral Valve Surgery Through Ministernotomy: Postoperative Results.

First author	Year	Patients	Location	Mortality	Stroke	Reop for bleeding	Infection	Hospital stay, d	30-d mod/sev MR	5-yr mod/sev MR
Karagoz (s) <sup>1</sup>	1999	54	Ankara	0	0	0	—	4.0	—	—
Karagoz (m) <sup>1</sup>	1999	11	Ankara	0	0	0	—	4.0	—	—
McClure <sup>2</sup>	2009	707	Boston	3	12	14	5	6.4	—	12%
Svensson <sup>3</sup>	2010	2,124	Cleveland	4	33	64	14	—	4%	—
Oezpeker <sup>4</sup>	2019	103	Innsbruck	0	1	0	—	7	—	—
Total/Mean		2,999		7 (0.2%)	46 (1.5%)	78 (2.6%)	19 (0.7%)	5.4 ± 1.5	4%	12%

Abbreviations: mod/sev, moderate/severe; MR, mitral regurgitation.



Partial J-sternotomy



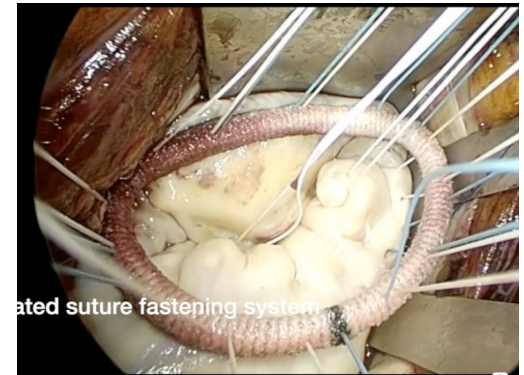
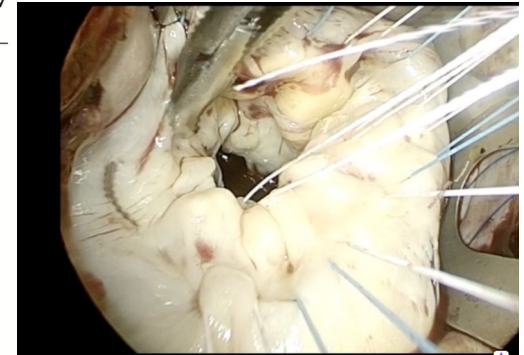
Bonatti J et al. Innovations (Phila). 2021 Jul-Aug;16(4):317-326.

# Minithoracotomy Approach

**Table 2.** Mitral Valve Surgery Through Minithoracotomy: Postoperative Results.

First author	Year	Patients	Location	Mortality	Stroke	Reop for bleeding	Infection	Hospital stay, d	30-d mod/sev MR	5-yr mod/sev MR
Casselmann <sup>7</sup>	2003	306	Aalst	3	1	—	1	9.1	—	—
Reichenspurner (cl) <sup>8</sup>	2005	60	Munich	1	0	1	—	9.2	0	—
Reichenspurner (b) <sup>8</sup>	2005	60	Munich	0	0	6	—	9.0	3.3%	—
Aybek <sup>9</sup>	2006	241	Frankfurt	8	2	9	0	8.1	—	8%
Ruttman <sup>10</sup>	2006	42	Innsbruck	1	—	—	—	—	2.4%	—
Seeburger <sup>11</sup>	2008	1,339	Leipzig	32	13	—	—	12.4	3.1%	—
Modi <sup>12</sup>	2009	1,178	USA	20	20	58	—	6.0	0.2%	—
Suri <sup>13</sup>	2009	350	USA	2	3	20	4	7.0	—	—
Wang <sup>14</sup>	2009	192	China	1	0	0	0	8.7	—	—
Iribarne <sup>15</sup>	2010	382	New York	7	4	14	—	7.8	—	—
Loforte (cl) <sup>16</sup>	2010	93	Rome	0	0	6	0	6.0	—	—
Loforte (b) <sup>16</sup>	2010	45	Rome	0	0	3	0	5.5	—	—
Grossi <sup>17</sup>	2012	1,282	New York	25	30	—	—	—	—	—
Mazine (cl) <sup>18</sup>	2013	103	Montreal	2	2	5	—	7.7	6.8%	—
Mazine (b) <sup>18</sup>	2013	140	Montreal	1	1	3	—	7.0	4.3%	—
Bentala (cl) <sup>19</sup>	2015	57	Netherlands	0	0	2	0	7.0	0%	—
Bentala (b) <sup>19</sup>	2015	164	Netherlands	2	3	5	0	6.0	1%	—
Nishi <sup>20</sup>	2015	765	Japan	2	6	22	0	14.0	—	—
Glauber <sup>21</sup>	2015	1,604	Massa	19	32	78	—	5.0	0.1%	6.4%
Tang <sup>22</sup>	2015	215	Durham	4	3	—	0	—	—	—
Atluri <sup>23</sup>	2016	91	Philadelphia	0	1	0	0	6.0	—	—
Downs <sup>24</sup>	2016	425	USA	5	4	—	0	4.0	—	—
Hawkins <sup>25</sup>	2018	295	Virginia	2	3	4	—	4.0	—	—
Malvindi <sup>26</sup>	2018	258	Bari	5	4	6	2	8.3	—	—
Barbero (cl) <sup>27</sup>	2018	250	Europe	4	2	28	0	9.0	—	—
Barbero (b) <sup>27</sup>	2018	250	Europe	2	2	8	1	8.0	—	—
Paparella <sup>28</sup>	2018	2,602	Italy	32	14	64	29	8.0	—	—
Grant <sup>29</sup>	2019	639	UK	12	9	—	—	6.0	—	—
Maruszewski <sup>30</sup>	2019	48	Warsaw	1	0	2	0	—	—	—
Total/Mean		13,476		193 (1.4%)	159 (1.2%)	344 (3.7%)	37 (0.6%)	7.6 ± 2.3	2.1%	7.2%

Abbreviations: mod/sev, moderate/severe; MR, mitral regurgitation.

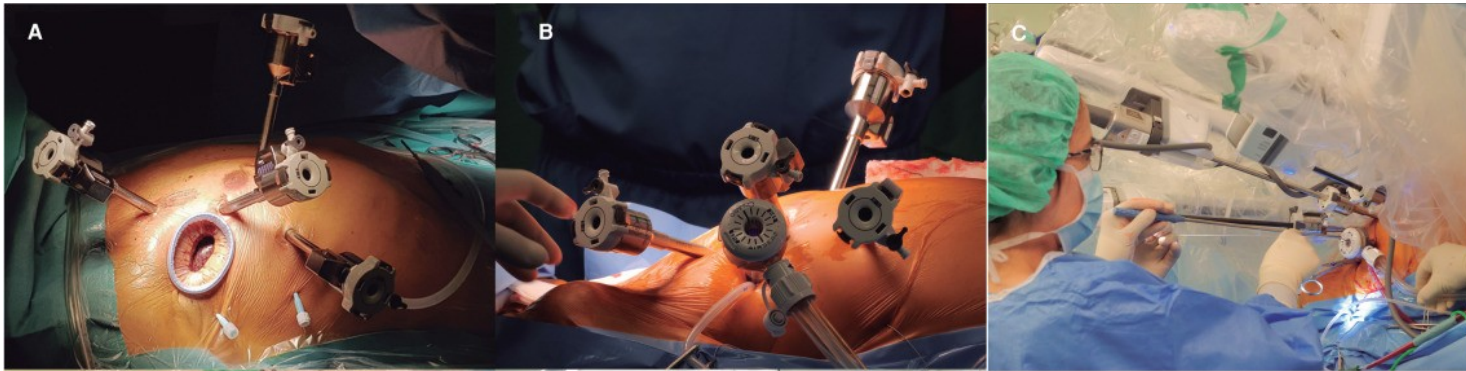


# Minithoracotomy Approach





# Robotic Approach



**Table 3.** Robotic Mitral Valve Surgery: Postoperative Results.

First author	Year	Patients	Location	Mortality	Stroke	Reop for bleeding	Infection	Hospital stay, d	30-d mod/sev MR	5-yr mod/sev MR
Mohr <sup>35</sup>	2001	17	Leipzig	0	—	—	—	10.0	0%	—
Tatooles <sup>36</sup>	2004	25	Oak Lawn	0	0	0	—	2.7	4%	—
Nifong <sup>37</sup>	2005	112	USA	0	0	3	—	4.7	1.8%	—
Folliguet <sup>38</sup>	2006	25	Paris	0	0	1	—	7.0	4%	—
Smith <sup>39</sup>	2007	18	Cincinnati	0	0	0	0	5.9	—	—
Suri <sup>40</sup>	2011	95	Rochester	0	1	—	0	3.0	0%	—
Nifong <sup>41</sup>	2012	540	Greenville	2	3	13	1	5.6	0.6%	—
Gao <sup>42</sup>	2012	22	Beijing	0	0	—	—	—	—	—
Ramzy <sup>43</sup>	2014	300	Los Angeles	1	6	14	1	6.0	8.3%	—
Yoo <sup>44</sup>	2014	200	Seoul	0	2	10	2	6.0	2%	13%
Murphy <sup>45</sup>	2015	1,257	Atlanta	11	9	28	4	4.9	—	—
Musumeci <sup>46</sup>	2015	6	Rome	0	0	0	0	5.0	—	—
Gillinov <sup>47</sup>	2018	1,000	Cleveland	1	14	25	0	5.0	2.1%	—
Kesavuori <sup>48</sup>	2018	142	Helsinki	1	0	11	2	7.0	—	—
Hawkins <sup>25</sup>	2018	295	Virginia	2	4	8	—	4.0	—	—
Kuo <sup>49</sup>	2018	52	Taiwan	0	1	1	0	7.0	—	—
Total/Mean		4,106		18 (0.4%)	40 (1.0%)	114 (2.9%)	10 (0.3%)	5.6 ± 1.8	2.5%	14%

Abbreviations: mod/sev, moderate/severe; MR, mitral regurgitation.

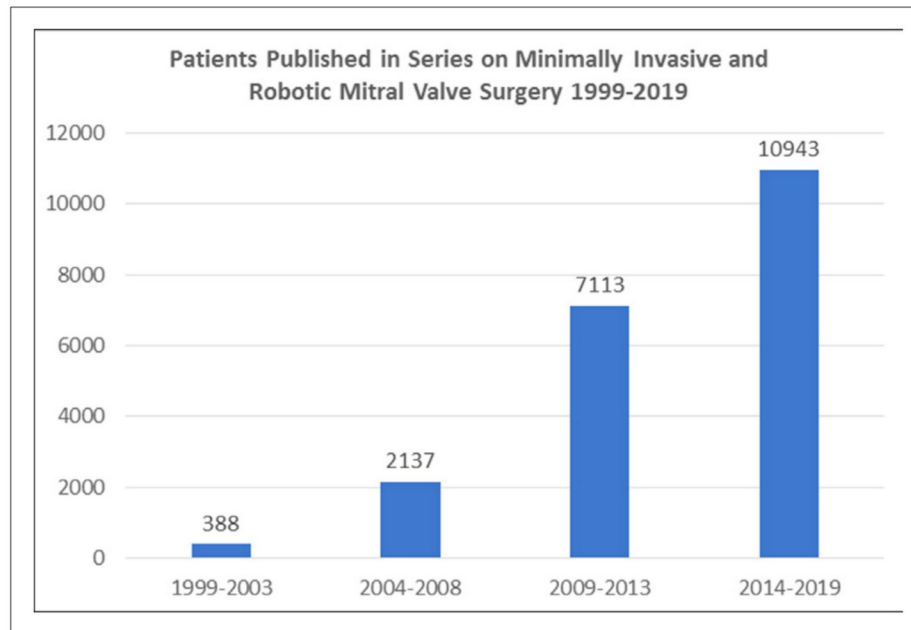
Sandoval E et al. Front Cardiovasc Med. 2023 Oct 6;10:1237151  
Bonatti J et al. Innovations (Phila). 2021 Jul-Aug;16(4):317-326.

# Comparison

**Table 4.** Grand Total: Postoperative Results.

Method	Papers	Publication years	Patients	Mortality	Stroke	Reop for bleeding	Infection	ICU hours	Hospital stay, d	30-d mod/sev MR	5-yr mod/sev MR
Ministernotomy	5	1999-2019	2,999	0.2%	1.5%	2.6%	0.7%	17.0	5.4	4.0%	12.0%
Minithoracotomy	29	2003-2019	13,476	1.4%	1.2%	3.7%	0.6%	30.0	7.6	2.1%	7.2%
Robotically assisted	16	2001-2018	4,106	0.4%	1.0%	2.9%	0.3%	28.9	5.6	2.5%	13.0%
Total/Mean	50	1999-2019	20,581	1.1%	1.2%	3.3%	0.5%	28.3	6.7	2.4%	9.9%
Available sample				20,581	20,522	16,199	12,793	9,907	16,848	9,185	2,752

Abbreviations: ICU, intensive care unit; mod/sev, moderate/severe; MR, mitral regurgitation.



Bonatti J et al. Innovations (Phila). 2021 Jul-Aug;16(4):317-326.

# Comparison

**Table 5.** Postoperative Results of Sternotomy Cases in Controlled Studies.

First author	Journal	Year	MI method control	Patients	Location	Mortality	Stroke	Reop for bleeding	Infection	Hospital stay, d
Svensson <sup>3</sup>	JTCVS	2010	Ministernotomy	1,047	Cleveland	19	17	46	4	—
Ruttman <sup>10</sup>	Eur Surg	2006	Minithoracotomy	64	Innsbruck	0	—	—	—	—
Suri <sup>13</sup>	ATS	2009	Minithoracotomy	365	Rochester	0	4	11	1	6.1
Wang <sup>14</sup>	ATS	2009	Minithoracotomy	203	China	1	—	—	—	9.8
Iribarne <sup>15</sup>	ATS	2010	Minithoracotomy	382	New York	7	10	11	—	7.0
Nishi <sup>20</sup>	Surg Today	2015	Minithoracotomy	5,381	Japan	60	69	78	35	21.0
Tang <sup>22</sup>	ATS	2005	Minithoracotomy	215	Durham	8	7	—	3	—
Atluri <sup>23</sup>	JTCVS	2016	Minithoracotomy	68	Philadelphia	0	1	0	—	7.0
Downs <sup>24</sup>	ATS	2016	Minithoracotomy	879	Virginia	24	11	—	0	—
Hawkins <sup>25</sup>	Heart	2018	Minithoracotomy	314	Virginia	7	3	6	—	5.0
Paparella <sup>28</sup>	Int J Cardiol	2018	Minithoracotomy	1,947	Italy	53	14	73	30	8.0
Grant <sup>29</sup>	Heart	2019	Minithoracotomy	639	UK	8	12	—	—	7.0
Folliguet <sup>38</sup>	EJCTS	2006	Robotic mitral	25	Paris	0	—	2	—	9.0
Suri <sup>40</sup>	JTCVS	2011	Robotic mitral	95	Rochester	0	0	—	0	—
Kesavuori <sup>48</sup>	JTCVS	2018	Robotic mitral	142	Helsinki	0	1	8	1	7.0
Total/Mean				11,766		187 (1.6%)	149 (1.3%)	235 (2.4%)	74 (0.7%)	8.7 ± 4.5

Abbreviations: MI, minimally invasive; mod/sev, moderate/severe; MR, mitral regurgitation.

# Conclusions

- Mini-MV surgery is concentrated in Europe, US East and West coast and in East Asia
- Repair rate is higher in Mini than in full sternotomy
- Perioperative mortality in Mini is acceptable and lower than Sternotomy
- Reexpl for bleeding is the higher (3.6%) in Minithoracotomy
- Further innovations will allow for a more and more minimally invasive surgery

**Thank You**