

Welcome to Medistim ASA's Interim report Q4 2021

The webinar will begin shortly

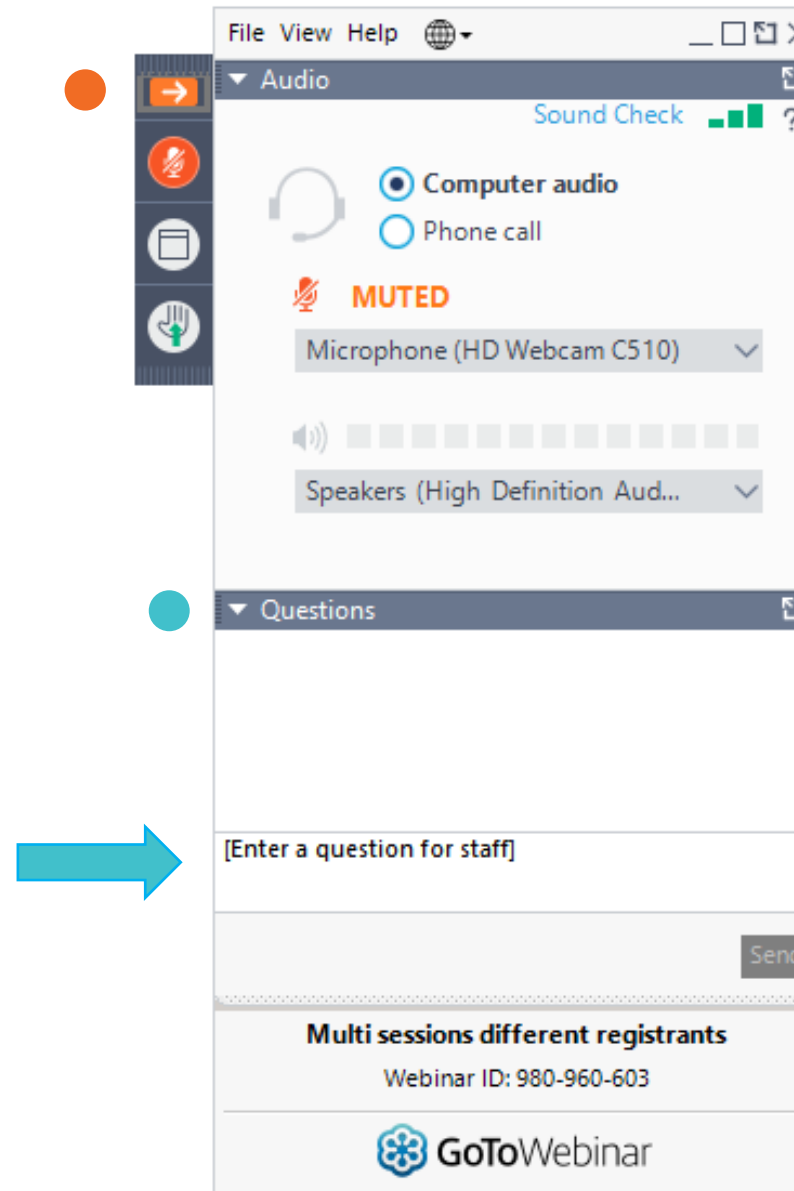


Before we start

You will be kept on mute during the presentation.

All questions will be answered at the end of the presentation

- Click on the arrow to expand or minimize your GoToMeeting panel
- Add any questions in the **questions** panel and we will answer them at the end of the presentation



Medistim ASA Q4 2021 and preliminary full year results

February 25th 2022



Kari E. Krogstad

PRESIDENT & CEO

Thomas Jakobsen

CFO



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01 Highlights

Highlights 4th Quarter

	Q4 2021	Q o Q
Revenue	MNOK 112.7 (94.2)	 +19.7 %
EBIT	MNOK 19.5 (22.1)	 -12.1 %
Currency		 - 7.1 %
Number of units sold or outplaced:		
Flow systems	52	 + 49 %
Imaging systems	25	 + 47 %
Flow probes (ex USA)	2 261	 + 27.9 %
Imaging probes	50	 + 100 %
Procedures (USA)	17 821	 + 28.2 %

All time high sales for a quarter

➤ 4th quarter in a row above MNOK 100 in sales revenues

- Imaging sales up 50.2% in NOK, Flow sales up 26.3% in NOK
- Vascular sales up 54.2% in NOK, Cardiac sales up 24.8 %in NOK
- Currency neutral growth was 26.8% in total and 38.4% for own products:
 - USA up 58.1%, Europe down 5.6%, Asia up 143%, RoW up 66%

➤ Third-party products down by 13.4 %

Weaker EBIT margin at 17.3% due to high activity level

The Board suggest a dividend of NOK 3.75 per share

Preliminary results for 2021

2021		Y o Y
Revenue	MNOK 427.3 (363.1)	 + 17.6 %
EBIT	MNOK 116.3 (95.5)	 + 21.8 %
Currency		 - 7.0 %
Number of units sold or outplaced:		
Flow systems	156	 + 5.4 %
Imaging systems	93	 + 50.0 %
Flow probes (ex USA)	7 988	 + 28.4 %
Imaging probes	154	 + 52.4 %
Procedures (USA)	72 032	 + 28.5 %

Best year ever for revenue and EBIT

- Record year for sales revenue, up 16.3% to MNOK 422
 - Imaging sales up 29.3%, Flow up 15.5% in NOK
 - Vascular sales up 21.1 %, Cardiac up 17.2% in NOK
 - Currency neutral growth was 24.6% in total and 26.0% for own products (excl. the PPP income)
 - USA up 28.4%, Europe up 15.7%, Asia up 50.7%, RoW up 2.4%
- Total revenue for the full year is up 17.6 % to MNOK 427.3 due to the extraordinary revenue of MNOK 5.3 from the COVID-related U.S. Paycheck Protection Program granted in Q2
- Third-party products grow by 10.0 %

Record EBIT margin at 27.3 %

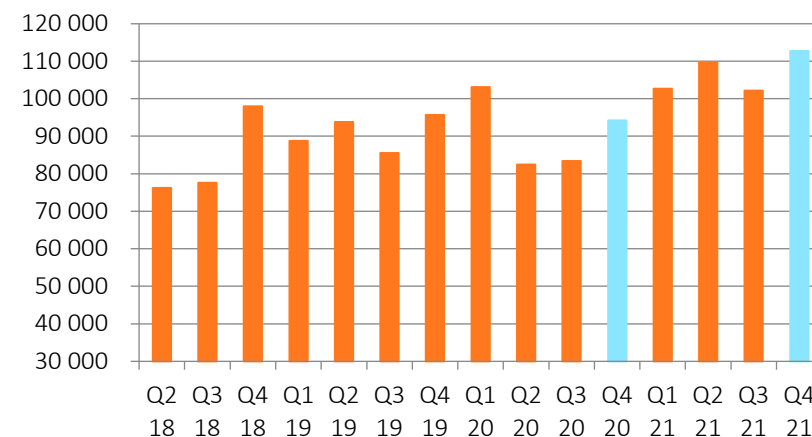


02 Financial Statements

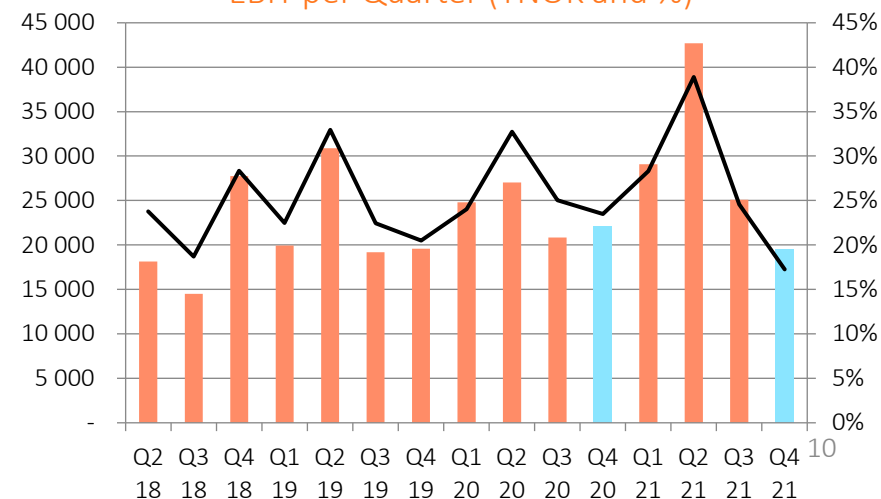
Profit and loss Q4 2021

Profit & loss	Q4 2021	Q4 2020
1=NOK 1000		
Sales revenue	112 740	94 184
Other revenue	-	-
Total revenue	112 740	94 184
Cost of goods sold	27 884	22 232
Salary and social expenses	41 418	32 177
Other operating expenses	17 951	11 348
Total operating expenses	87 252	65 756
EBITDA	25 488	28 429
EBITDA%	22,61 %	30,18 %
Depreciation	6 027	6 293
Operating result (EBIT)	19 461	22 136
EBIT %	17,26 %	23,50 %
Financial income	1 664	1 433
Financial expenses	1 710	3 648
Net finance	(46)	(2 216)
Pre tax profit	19 415	19 920
Tax	3 302	6 352
Profit after tax	16 113	13 568
Dividend	-	-

Sales per Quarter (TNOK)



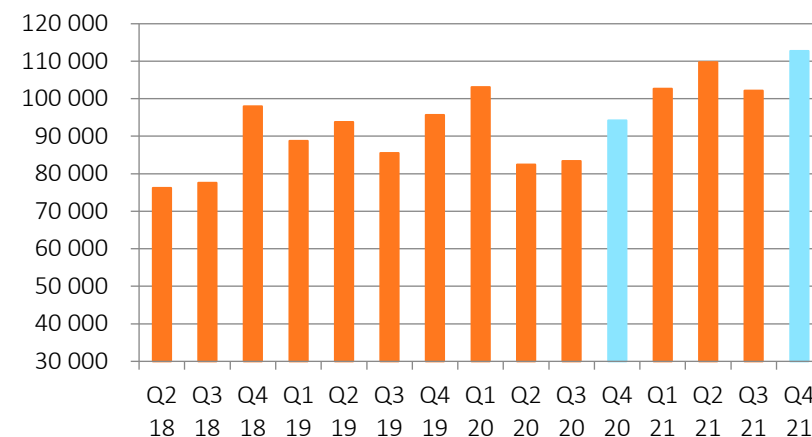
EBIT per Quarter (TNOK and %)



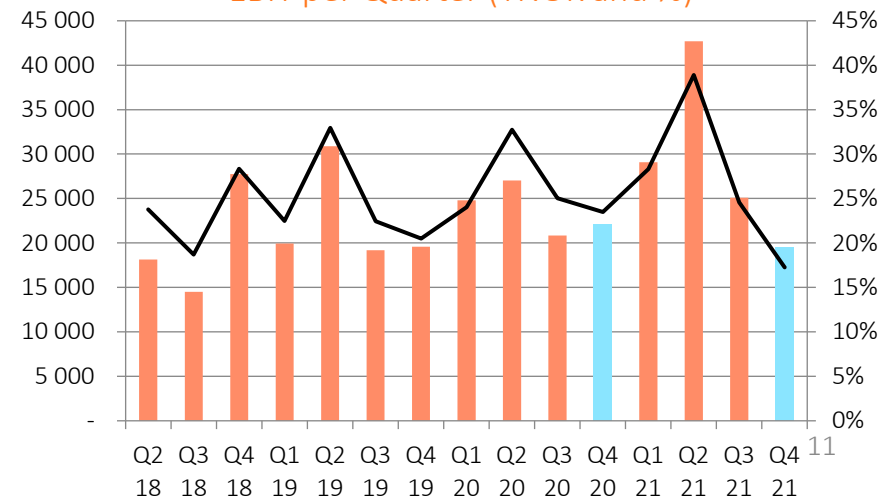
Profit and loss 2021 (preliminary)

Profit & loss	FY 2021	FY 2020
1=NOK 1000		
Sales revenue	421 984	363 133
Other revenue	5 292	-
Total revenue	427 276	363 133
Cost of goods sold	97 114	76 577
Salary and social expenses	134 507	119 066
Other operating expenses	55 950	48 865
Total operating expenses	287 571	244 508
EBITDA	139 705	118 626
EBITDA%	33,11 %	32,67 %
Depreciation	23 427	23 141
Operating result (EBIT)	116 278	95 484
EBIT %	27,56 %	26,29 %
Financial income	8 173	14 137
Financial expenses	10 380	18 015
Net finance	(2 207)	(3 878)
Pre tax profit	114 071	91 606
Tax	23 171	22 219
Profit after tax	90 900	69 387
Dividend	54 640	50 052

Sales per Quarter (TNOK)



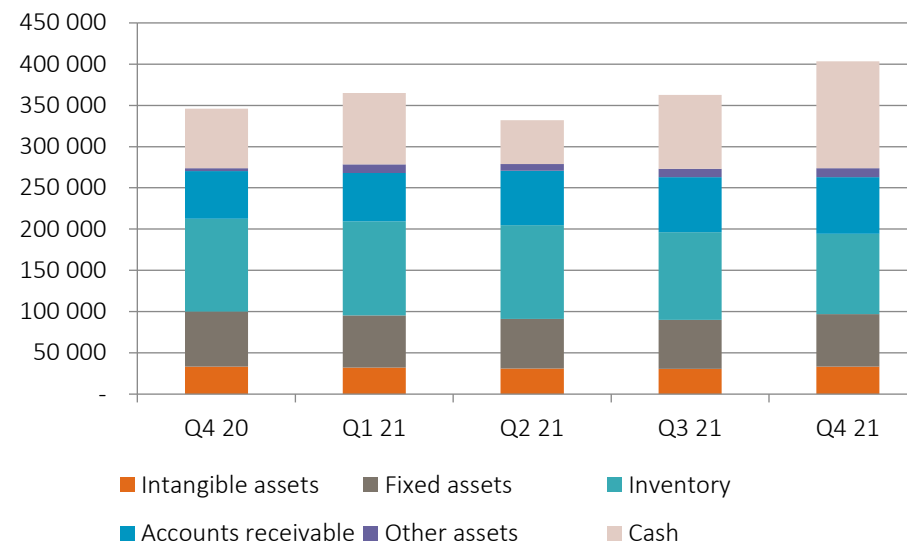
EBIT per Quarter (TNOK and %)



Balance sheet – Assets

- Cash position by end of the year was MNOK 129.5
- Securing end-of-life components and keeping security stocks explain the high inventory level. Still, somewhat reduced due to longer lead times for some components.
- The Board propose a dividend of NOK 3.75 per share, total MNOK 68.4

Balance sheet	31.12.2021	31.12.2020
<i>All numbers in NOK 1000</i>		
Assets		
Intangible assets	33 410	33 464
Fixed assets	63 337	66 570
Total intangible and fixed assets	96 747	100 034
Inventory	97 413	112 667
Customers receivables	68 634	57 485
Other receivables	10 960	3 744
Cash	129 490	71 891
Total current assets	306 497	245 786
Total assets	403 244	345 820



Balance sheet **31.12.2021** **31.12.2020**

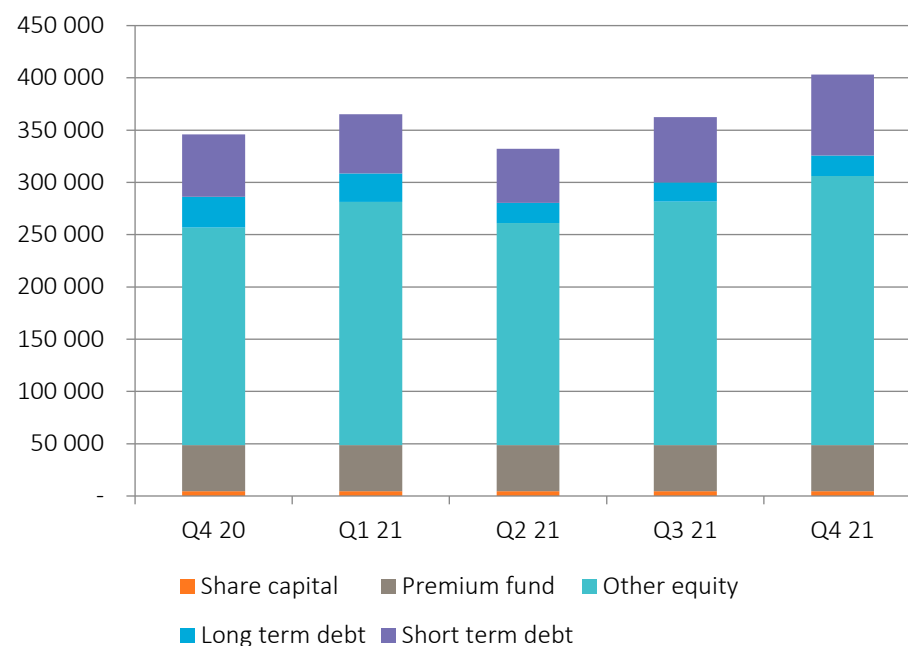
All numbers in NOK 1000

Share capital	4 585	4 585
Premium fund	44 172	44 172
Other equity	257 295	208 089
Total equity	306 052	256 846

Total long term debt	19 589	29 497
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Total short term debt	77 603	59 477
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Total equity and liability	403 244	345 820
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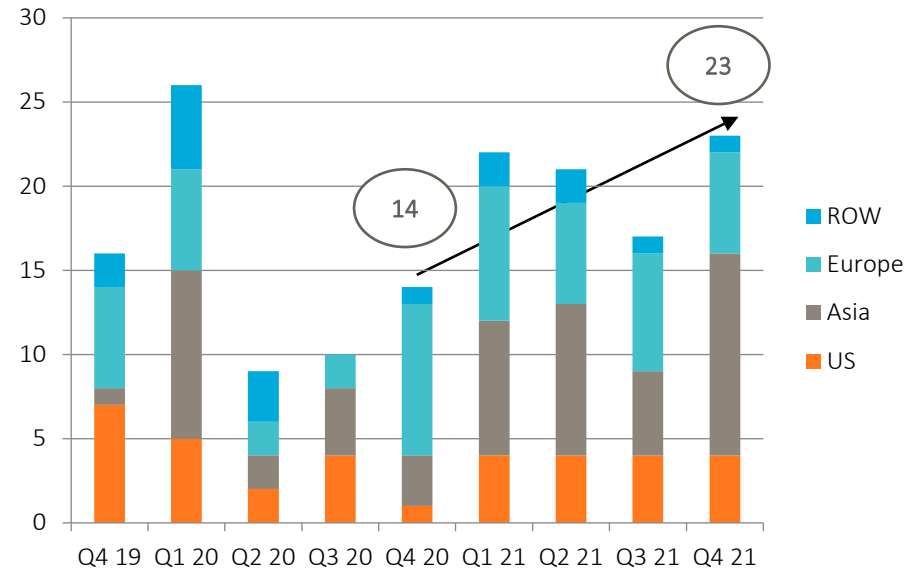
Balance sheet – Equity and Liability

- No interest-bearing debt
- 24.2 MNOK in obligations related to lease contracts where 17.1 MNOK is long term
- Strong balance sheet with 75.9 % equity ratio



03 Business segments update

Imaging systems in units (capital sales)

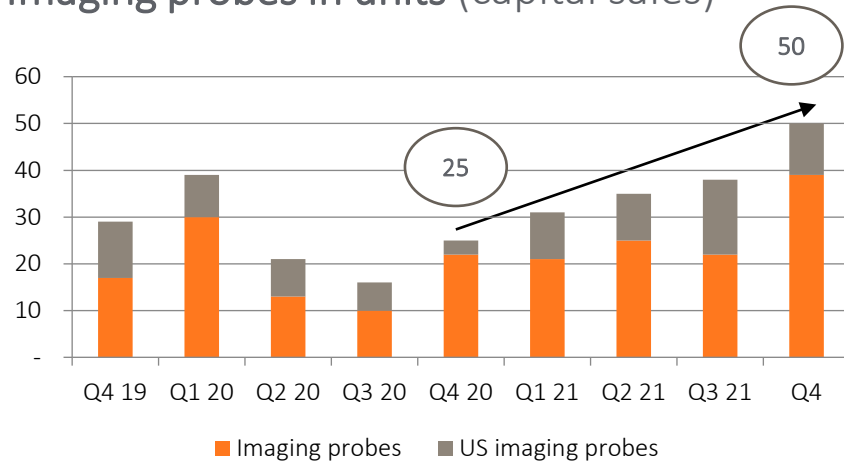


Imaging probes and systems in units

Unit sales of imaging systems sold as capital equipment continue to be strong, **growing 64%** this quarter

Unit sales of imaging probes are also recovering strongly, **growing 100%** this quarter

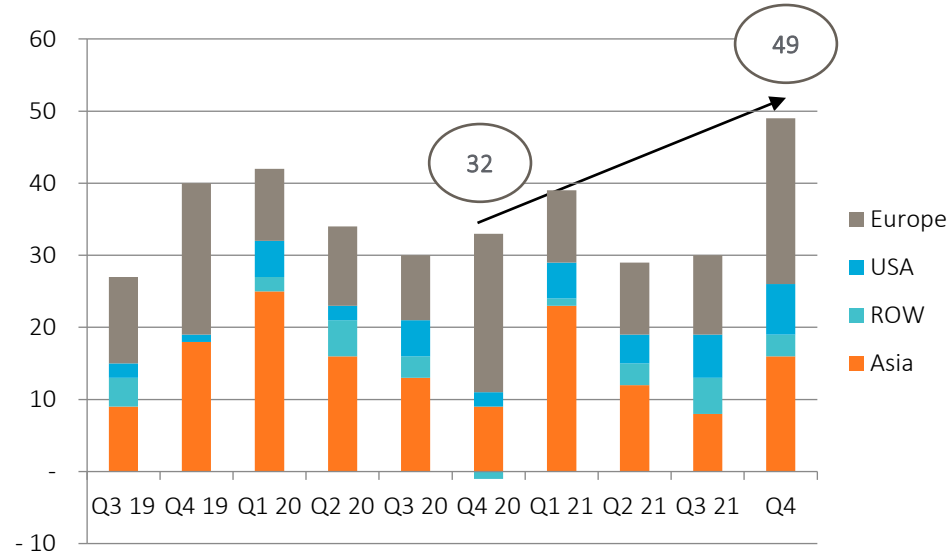
Imaging probes in units (capital sales)



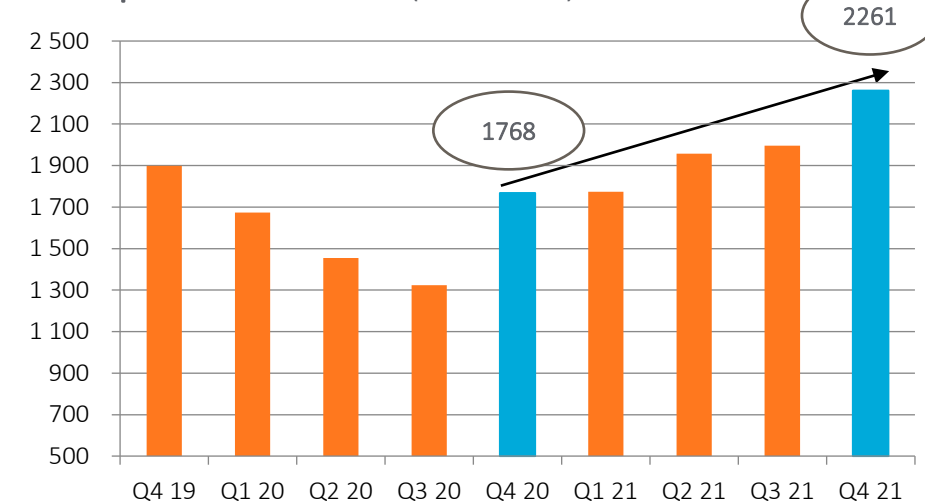
Flow probes and systems in units

- Number of flow systems sold as capital equipment is up 53% from Q4 last year.
- It is Medistim's strategy to convert the market from Flow-only to Flow-and-Imaging technology
- The **total sale of systems** (Flow and Flow-and-Imaging) sold as capital equipment shows an increase of 26 units or 56%
- 27.9% growth in number of flow probes sold this quarter reflects that the surgical **activity level is getting back to normal and filling the pent-up demand**

Flow systems in units (capital sales)



Flow probes in units (excl USA)



Revenue performance by region

Mill NOK	Q4 21	Q4 20	Q / Q	2021	2020	Y / Y
Europe	49,3	55,8	-11,6 %	190,2	173,3	9,8 %
USA	39,1	27,0	44,9 %	154,1	126,4	21,9 %
Asia	20,3	8,8	129,9 %	66,8	46,8	42,7 %
ROW (MEA, CAN, SA, AUS)	4,0	2,5	57,3 %	16,1	16,7	-3,0 %
Total	112,7	94,2	19,7 %	427,3	363,1	17,7 %

- In Europe, Q4 sales of own products decreased with 10.5% in NOK and 5.6% currency neutral. For 2021, sales of own products increased with 9.6% in NOK and 15.7% currency neutral. 3. party decreased with 13.4% in Q4 and increased 10.0% for 2021.
- In the USA, currency neutral sales for the quarter increased with 58.1%. Total revenues for 2021 include the extraordinary MNOK 5.3 related to the U.S. Paycheck Protection Program. When excluding this, currency neutral increase for the year was 28.4 %.
- In Asia, solid growth both for the quarter and YTD.
- ROW continues to be a smaller sales territory for Medistim, with significant quarter to quarter variation.

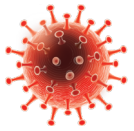
Negative currency effects for 2021 vs 2020 was 25 MNOK.

Average actual exchange rate for USD 8.59 and EUR 10.16 versus last year USD 9.37 and EUR 10.73.

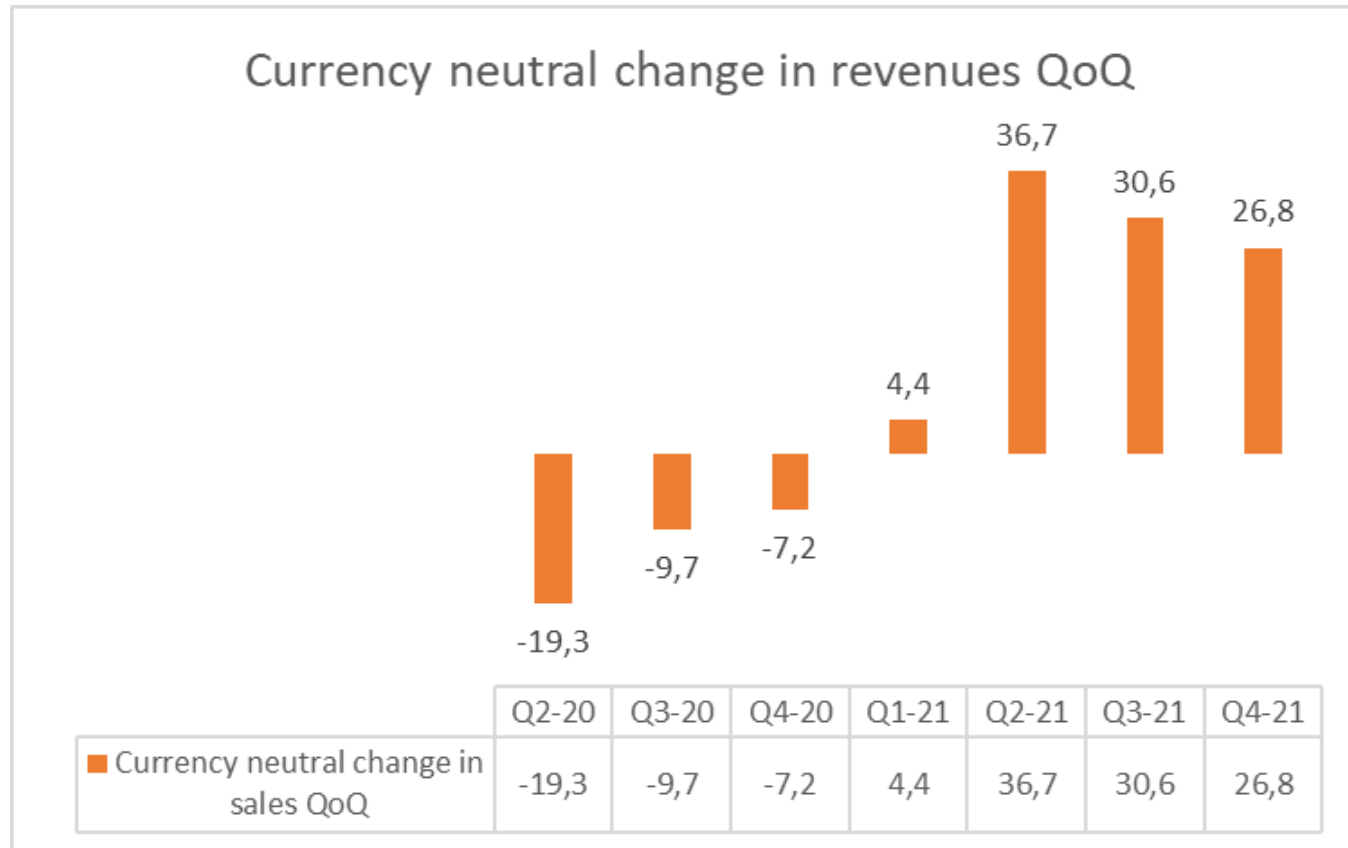
Revenue performance by product category

Mill NOK	Q4 21	Q4 20	Q / Q	2021	2020	YoY
Procedures (USA)	28,6	23,4	22,3 %	111,8	99,4	12,5 %
Flow probes	30,3	22,8	32,8 %	115,7	92,6	24,9 %
Flow systems (MiraQ)	17,6	13,5	30,2 %	51,0	47,2	8,0 %
Imaging systems (MiraQ)	15,1	10,0	51,4 %	57,9	44,2	31,0 %
Imaging probes	2,0	1,3	57,3 %	7,1	5,2	36,4 %
3rd party	18,4	21,2	-13,4 %	74,3	67,5	10,1 %
Other	0,8	2,0	-62,3 %	9,5	6,9	36,6 %
Total revenues	112,7	94,2	19,7 %	427,3	363,1	17,7 %

- **Procedure sale in the USA:** The total number of procedures increased with 28.2% for the quarter and 28.5 % for 2021. Lower % growth in NOK is mainly explained by unfavorable currency.
- **Flow probes:** In units, the growth is 27.9 % for the quarter and 28.5 % for 2021. The higher % growth in NOK for the quarter is due to higher sales through direct channels. For the year, unfavorable currency reduces sales in NOK.
- **Flow systems (capital):** Units increases with 53% for the quarter and 6.5% for the year. Strong sales through distributors results in lower sales in NOK for the quarter. For the year, increased sales through direct channels compensates for a stronger NOK.
- **Imaging systems (capital):** 64% increase in capital units for the quarter and 41% for the year. The lower increase in NOK is related currency and to high sales through distributors this quarter.
- **3rd party products:** Slow quarter but strong sales for the year.
- **Other:** Includes an extraordinary revenue of MNOK 5.3 related to the U.S. Paycheck Protection Program

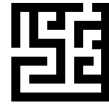


Covid-19: From gradually decreasing impact to strong recovery



Not completely back to normal

- Still some travel and hospital access restrictions
- In some countries, and some states in the U.S.A., elective surgeries may still be postponed



04 Implementing the strategy

Medistim growth strategy

GEOGRAPHIES

Emerging high-growth economies (e.g. BRIC)	3		
Developing Medistim markets (e.g. USA, UK, France)	2		
Strong Medistim markets (e.g. Jp, Nordic, Germany) >50% CABG share	1	4	
	CABG surgery (2 BNOK)	Vascular surgery (>1 BNOK)	Other open heart surgery (1BNOK)

APPLICATION AREAS

1. **Convert** the routine Flow market to a Flow-and-Imaging market by establishing *Surgical Guidance and Quality Assessment* as the new standard of care through
 - Early adopter & KOL support
 - REQUEST study
 - Ease conversion from flow to imaging with MiraQ
2. **Achieve routine use** of both Flow and Imaging by fighting ignorance, indifference and ease-of-use objections through
 - Clinical marketing, guidelines and educational programs
 - Product innovation for ease of use
 - Increased sales force capacity
3. Offer an **entry-level** solution to reach emerging, price-sensitive, high-growth markets
4. Build and **strengthen position in vascular** surgery
 - Dedicated system (MiraQ Vascular) & probes
 - Build position with societies and KOLs
5. Expand our **direct** market coverage



Developing the US market

Performance US sales

- Currency neutral sales revenue grows by 58.1% in Q4 and 28.4%*) for 2021

*) When including the Paycheck Protection Program revenue of TUSD 630, total revenue grows by 33%

- Total number of procedures was up 28.2% in Q4 and 28.5% for 2021

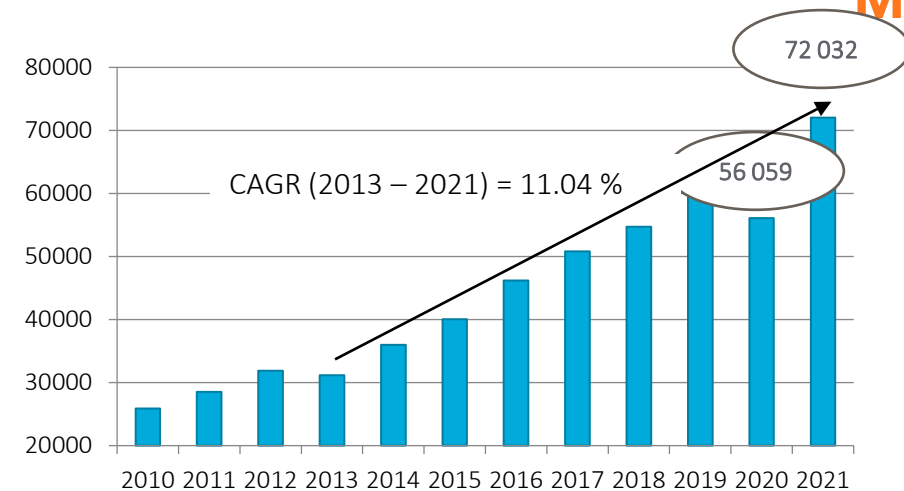
- Flow procedures up 22.5% in Q4
- Imaging procedures up 63.6% in Q4

- Strong capital systems sales

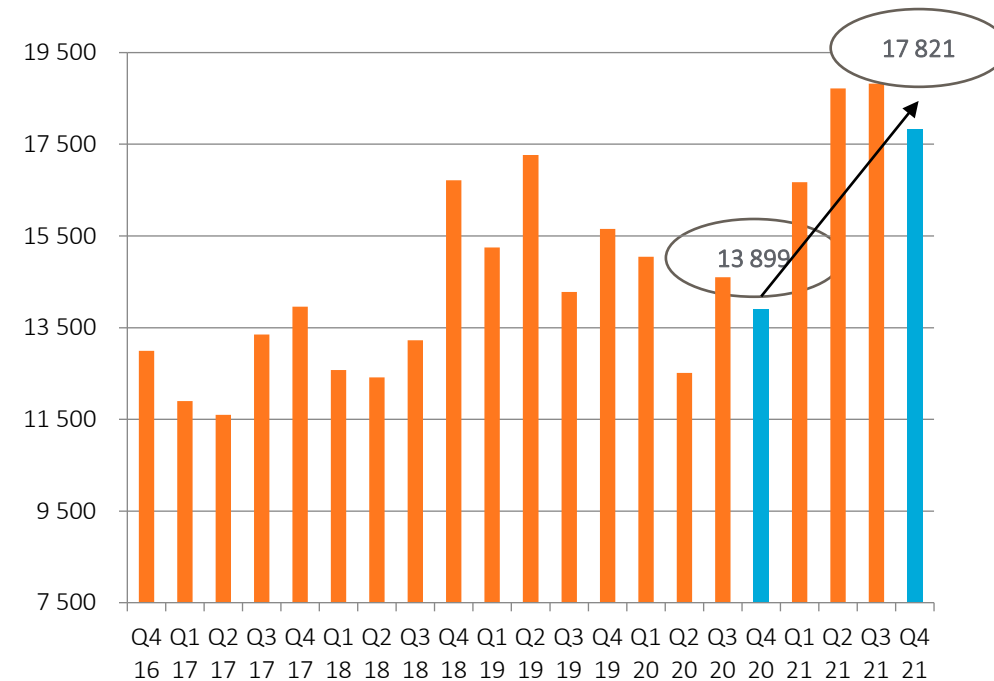
- 11 units in Q4 vs 3 LY
- 38 units in 2021 vs 26 LY

- Strong growth in new customers

- 7 (7) new customers in Q4
- 40 (25) new customers in 2021



■ Number of procedures per year



■ Number of procedures per quarter

Medistim growth strategy

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Clinical marketing

2021 – a breakthrough year for expert CONSENSUS STATEMENTS

● Cementing the clinical value of Transit Time Flow Measurement (TTFM) in CABG

● Potential to accelerate change in clinical practice

● Influencing new and stronger clinical guideline endorsements

Editorial

Intraoperative Graft Patency Assessment: Time to Recognize the Elephant Outside the Operating Room?

Innovations
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Gregory D. Trachiotis¹, MD, Michael A. Napolitano^{1,2}, MD, Ethan S. Rosenfeld^{1,2}, MD, and David P. Taggart¹, MD, PhD

Editorial

Introduction

Coronary artery bypass grafting (CABG) commonly performed procedure for the treatment of coronary artery disease. The metrics for success of CABG on decreasing mortality, improving quality of life, and symptom severity. All of these outcomes are technical success of the operation itself, but the technical success of the procedure in several tools are available, including transthoracic echocardiography (TTE), high-frequency (HFUS), Fig. 2, Fig. 3), thermal coronary anastomosis, and intraoperative echocardiography to immediately evaluate valve replacement/repair is widely accepted. However, although CABG is technically demanding, with regard to precision, and where distal anastomosis is <1 mm, there is no operative quality assessment of grafts or the anastomosis. Furthermore, it is inconceivable that a cardiologist would not perform a complete assessment of the procedure in a CABG patient, a procedure that is more demanding than a bypass graft. It is also both off-pump CABG (OPCAB) and use of which have well-defined roles in part to increase that level of technical complexity.

Perioperative graft failure may occur in 9% of patients undergoing CABG surgery, though underutilized, tool to address this is rarely discussed “elephant outside the box” (Supplemental Video). The first published CABG date back to 1994 in 2 separate publications as well as Carver and Dume. Since that time, it has been well validated as a means of intraoperative assessment, and from 2010 through its most recent European Society of Cardiology and European Association of Cardio-Thoracic Surgery guidelines.

In spite of the above, in the United States, over 4 million CABG receive more than one arterial bypass graft. The lack of widespread adoption including increased technical complexity and higher suboptimal results with RA use, wound healing, bilateral ITA (BITA) harvesting especially in dialysis to the somewhat long latency period, and the decade from index operation, until the impact of it with MAG is generally realized.¹⁻⁴

While MAG may not be suitable to all CABG use of arterial grafts is encouraged and shows heart-team discussion in determining the optimization strategy.⁵ The strategy of revascularization among patients, taking into consideration of

Introduction

Coronary artery bypass grafting (CABG), introduced over 50 years ago at the Cleveland Clinic, has remained the gold standard in multivessel coronary artery disease with heavy burden.¹ While utilizing the internal thoracic artery (ITA) as the left anterior descending artery (LAD) cornerstone of CABG since 1986,² there has been a resurgence in the importance of multiarterial grafting. The use of at least 2 arterial grafts, resulting in a higher freedom from major adverse cardiac events (MACE).^{3,4} Indeed, the most recent CABG guideline set forth by the Society of Thoracic Surgeons (STS) recommends the use of the ITA graft to the LAD, multivessel disease, with the use of additional ITA (RA) grafts.⁵ The incremental benefit of graft has been somewhat equivocal, although observational studies suggested better long-term survival with 3, compared to 2, arterial grafts.⁶

The outcome advantage attained with CABG percutaneous coronary intervention is most pronounced in patients that receive at least one ITA conduit, in particular the ITA, are rarely affected by atherosclerosis making them ideal conduits to use with lower rates. The ITA has unique biological characteristics that may also explain the long-term survival benefit that may also explain the long-term survival benefit that may also explain the long-term survival benefit.

Several modalities for intraoperative quality assessment of CABGs exist, among them coronary angiography and intraoperative fluorescence imaging. However, these are limited mainly by cost and/or practical applicability. Intraoperative transit time flow measurement (TTFM) is the technology most frequently adopted, yet it is used in only 20% of CABG procedures in the United States.⁷

The most frequently cited limitations to widespread adoption are:

- a lack of standardization of how TTFM should be performed;
- a lack of standardization of how TTFM measurements should be interpreted, based on the concern that some grafts may be revised unnecessarily;
- the expectation that TTFM should be able to predict not only the immediate intraoperative status of the graft but also long-term patency and clinical outcomes, for which there is little robust evidence;
- intraoperative quality control is not addressed in current clinical practice guidelines of any of the North American cardiovascular societies; and
- differences in opinion among CABG leaders exist as to when TTFM should be used.

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The 10 Commandments for Multiarterial Grafting

Rami Akhrass¹, MD and Faisal G. Bakaeen¹, MD

DOI: 10.1111/jocs.15994

EDITORIAL

Journal of
CARDIAC SURGERY WILEY

Transit time flow measurement in coronary artery bypass grafting: For every patient and every surgeon

Quality assurance in cardiac surgery has evolved over the past decade to include intraoperative performance measures, predicated on the fact that intraoperative evaluation of quality leads to improved patient outcomes. Routine intraoperative quality control measures have been implemented in most aspects of cardiac surgery, including treatment of structural valve disease, and congenital and pediatric cardiac surgery. However, this is not the case in coronary surgery.

In the United States, 18.2 million adults age 20 and older have coronary artery disease.¹ With close to 200,000 coronary artery bypass graft (CABG) surgeries performed in the U.S. per year,² this is the most frequently performed cardiac surgical procedure. The STS Adult Cardiac Surgery performance measure assesses surgical performance based on a combination of CABG process and outcomes measures, including risk-adjusted operative mortality and morbidity, use of an internal mammary artery, and secondary prevention measures at discharge.³ And yet, the ultimately relevant outcomes for the patient—survival and symptom relief—are based on a single primary underlying premise—that the patient leaves the operating room with functioning grafts. So why is there no routine intraoperative graft quality control measure in place in coronary surgery?

Several modalities for intraoperative quality assessment of CABGs exist, among them coronary angiography and intraoperative fluorescence imaging. However, these are limited mainly by cost and/or practical applicability. Intraoperative transit time flow measurement (TTFM) is the technology most frequently adopted, yet it is used in only 20% of CABG procedures in the United States.⁴

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- intraoperative quality control is not addressed in current clinical practice guidelines of any of the North American cardiovascular societies; and
- differences in opinion among CABG leaders exist as to when TTFM should be used.

review-article

Circulation

IN DEPTH

The Use of Intraoperative Transit Time Flow Measurement for Coronary Artery Bypass Surgery: Systematic Review of the Evidence and Expert Opinion Statements

Mario Gaudino¹, MD, MSCE; Sigrid Sandner², MD; Gabriele Di Giammarco, MD; Antonino Di Franco, MD; Hirokuni Arai, MD; Tohru Asai³, MD; Faisal Bakaeen, MD; Torsten Doenst, MD; Stephen E. Fries⁴, MD; David Glineur, MD; Teresa M. Kieser⁵, MD, PhD; Jennifer S. Lawton, MD; Roberto Lorusso, MD; Nirav Patel, MD; John D. Puskas, MD; James Tavloulis, MD; David P. Taggart, MD; Michael Vallely, MD; Marc Ruef⁶, MD

ABSTRACT: Transit time flow measurement (TTFM) allows quality control in coronary artery bypass grafting but remains largely underused, probably because of limited information and the lack of standardization. We performed a systematic review of the evidence on TTFM and other methods for quality control in coronary artery bypass grafting following PRISMA standards and elaborated expert recommendations by using a structured process. A panel of 19 experts took part in the consensus process using a 3-step modified Delphi method that consisted of 2 rounds of electronic voting and a final face-to-face virtual meeting. Eighty percent agreement was required for acceptance of the statements. A 2-level scale (strong, moderate) was used to grade the statements based on the perceived likelihood of a clinical benefit.

The existing evidence supports an association between TTFM readings and graft patency and postoperative clinical outcomes, although there is high methodological heterogeneity among the published series. The evidence is more robust for arterial, rather than venous, grafts and for grafts to the left anterior descending artery. Although TTFM use increases the duration and the cost of surgery, there are no data to justify this effect. Based on the systematic review, 10 expert statements for TTFM use in clinical practice were formulated. Six were approved at the first round of voting, 3 at the second round, and 1 at the virtual meeting.

In conclusion, although TTFM use may increase the costs and duration of the procedure and requires a learning curve, its cost/benefit ratio seems largely favorable, in view of the potential clinical consequences of graft dysfunction. These consensus statements will help to standardize the use of TTFM in clinical practice and provide guidance in clinical decision-making.

Key Words: coronary artery bypass ■ quality control ■ time

Intraoperative quality control is standard practice in every aspect of contemporary cardiac surgery but remains underused in coronary artery bypass grafting (CABG). Transit time flow measurement (TTFM) allows quality control in CABG by intraoperative evaluation of coronary graft function, but it is currently adopted in only 30% of the procedures.¹

the reluctance to its widespread adoption by the surgical community is likely based on limited information, and concerns pertaining to the lack of standardization and familiarity with TTFM interpretation, as well.

In this article, a group of coronary surgeons with extensive experience with TTFM performed a systematic review of the existing evidence and critically evaluated

Pivotal review-article in CIRCULATION, Oct 5th 2021

- Published in Circulation, the top 1-2 journal in cardiology and cardiovascular medicine
- Authored by 19 world renowned cardiac surgeon experts (4 from REQUEST study) from all over the world

	Title	Type	↓ SJR	H Index	Total Docs. (2020)	Total Docs. (3years)	Total Refs. (2020)	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc. (2020)	
1	Journal of the American College of Cardiology	journal	10.315 Q1	431	935	2960	22363	23475	1191	7.44	23.92	🇺🇸
2	Circulation	journal	7.795 Q1	607	778	2685	22242	26532	1702	9.48	28.59	🇺🇸
3	JACC: Heart Failure	journal	6.123 Q1	67	184	596	2888	2708	262	4.38	15.70	🇳🇱
4	JAMA Cardiology	journal	6.108 Q1	63	349	944	4752	4608	486	4.92	13.62	🇺🇸
5	JACC: Cardiovascular Imaging	journal	5.790 Q1	120	481	1051	9756	4889	422	4.57	20.28	🇺🇸
6	Nature Reviews Cardiology	journal	5.495 Q1	130	175	550	8971	3856	268	7.24	51.26	🇬🇧
7	European Journal of Heart Failure	journal	5.149 Q1	133	397	855	12087	5341	445	6.01	30.45	🇺🇸
8	Circulation Research	journal	4.899 Q1	336	352	1256	19861	10880	933	7.71	56.42	🇺🇸
9	European Heart Journal	journal	4.336 Q1	293	1008	2579	16028	14482	1859	5.52	15.90	🇬🇧
10	Journal of Heart and Lung Transplantation	journal	3.549 Q1	135	1537	645	4734	3313	371	4.74	3.08	🇺🇸
11	Stroke	journal	3.397 Q1	319	775	2080	15700	11233	1632	4.99	20.26	🇺🇸

review-article

Circulation

IN DEPTH

The Use of Intraoperative Transit Time Flow Measurement for Coronary Artery Bypass Surgery Systematic Review of the Evidence and Expert Opinion Statements

Mario Gaudino¹, MD, MSCE; Sigrid Sandner², MD; Gabriele Di Giammarco, MD; Antonino Di Franco, MD; Hirokuni Arai, MD; Tohru Asa³, MD; Faisal Bakaeen, MD; Torsten Doentz, MD; Stephen E. Fremes⁴, MD; David Glineur, MD; Teresa M. Kieser⁵, MD, PhD; Jennifer S. Lawton, MD; Roberto Lorusso, MD; Nirav Patel, MD; John D. Puskas, MD; James T. Tatoulis, MD; David P. Taggart, MD; Michael Vallety, MD; Marc Rue⁶, MD

ABSTRACT: Transit time flow measurement (TTFM) allows quality control in coronary artery bypass grafting but remains largely underused, probably because of limited information and the lack of standardization. We performed a systematic review of the evidence on TTFM and other methods for quality control in coronary artery bypass grafting following PRISMA standards and elaborated expert recommendations by using a structured process. A panel of 19 experts took part in the consensus process using a 3-step modified Delphi method that consisted of 2 rounds of electronic voting and a final face-to-face virtual meeting. Eighty percent agreement was required for acceptance of the statements. A 2-level scale (strong, moderate) was used to grade the statements based on the perceived likelihood of a clinical benefit.

The existing evidence supports an association between TTFM readings and graft patency and postoperative clinical outcomes, although there is high methodological heterogeneity among the published series. The evidence is more robust for arterial, rather than venous, grafts and for grafts to the left anterior descending artery. Although TTFM use increases the duration and the cost of surgery, there are no data to quantify this effect. Based on the systematic review, 10 expert statements for TTFM use in clinical practice were formulated. Six were approved at the first round of voting, 3 at the second round, and 1 at the virtual meeting.

In conclusion, although TTFM use may increase the costs and duration of the procedure and requires a learning curve, its cost/benefit ratio seems largely favorable, in view of the potential clinical consequences of graft dysfunction. These consensus statements will help to standardize the use of TTFM in clinical practice and provide guidance in clinical decision-making.

Key Words: coronary artery bypass ■ quality control ■ time

Intraoperative quality control is standard practice in every aspect of contemporary cardiac surgery but remains underused in coronary artery bypass grafting (CABG). Transit time flow measurement (TTFM) allows quality control in CABG by intraoperative evaluation of coronary graft function, but it is currently adopted in only 30% of the procedures.¹

Current myocardial revascularization guidelines provide only generic recommendations on TTFM use,^{2,3} and

the reluctance to its widespread adoption by the surgical community is likely based on limited information, and concerns pertaining to the lack of standardization and familiarity with TTFM interpretation, as well.

In this article, a group of coronary surgeons with extensive experience with TTFM performed a systematic review of the existing evidence and critically evaluated the available data. Because of the high statistical and methodological heterogeneity of the published stud-

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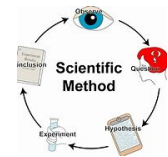
The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.
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“The Use of Intraoperative TTFM for CABG”

Circulation, October 2021



Method

- Systematic review of 229 publications
 - 2,200 articles identified
 - 1,550 screened
 - 38 cited in the review
- 10 expert statements for TTFM use were formulated
 - 2 x electronic voting, 1 F2F
 - 80% agreement was required for acceptance of the statements
 - 2-level scale for clinical benefit (strong, moderate)

Conclusion

CONSENSUS STATEMENTS #1:

“TTFM should be used
in every CABG case”

“These consensus statements will help to
standardize the use of TTFM in clinical practice
and provide **guidance** in clinical decision-
making”

review-article

Circulation

IN DEPTH

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Systematic Review of the Evidence and Expert Opinion Statements

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20 largest shareholders per February 22nd

Rank	Holding	Stake %	Name	Citizenship	Type of account
1	1 862 500	10.15687	AETERNUM CAPITAL AS	Norway	Ordinary
2	1 285 000	7.00756	FLØTEMARKEN AS	Norway	Ordinary
3	1 206 680	6.58045	State Street Bank and Trust Comp	United States	Nominee
4	1 200 000	6.54403	VERDIPAPIRFOND ODIN NORDEN	Norway	Ordinary
5	1 120 288	6.10933	State Street Bank and Trust Comp	United States	Nominee
6	991 437	5.40666	Skandinaviska Enskilda Banken AB	Sweden	Nominee
7	970 000	5.28975	FOLLUM INVEST AS	Norway	Ordinary
8	651 953	3.55533	State Street Bank and Trust Comp	United States	Nominee
9	600 000	3.27201	ODIN Small Cap	Sweden	Ordinary
10	575 793	3.14000	Skandinaviska Enskilda Banken AB	Denmark	Nominee
11	414 011	2.25775	Skandinaviska Enskilda Banken AB	Sweden	Nominee
12	406 752	2.21816	State Street Bank and Trust Comp	United States	Nominee
13	398 823	2.17492	SKANDINAVISKA ENSKILDA BANKEN AB	Luxembourg	Nominee
14	382 845	2.08779	The Northern Trust Comp, London Br	United States	Nominee
15	379 936	2.07193	BUANES	Norway	Ordinary
16	266 881	1.45540	RBC Investor services bank S.A.	Luxembourg	Nominee
17	257 500	1.40424	The Bank of New York Mellon SA/NV	Denmark	Nominee
18	238 314	1.29961	Skandinaviska Enskilda Banken AB	Sweden	Nominee
19	232 194	1.26624	BNP Paribas Securities Services	Italy	Nominee
20	228 000	1.24336	Danske Invest Norge Vekst	Norway	Ordinary

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