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The webinar will begin shortly

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- Click on this arrow to expand or minimize your GoToMeeting panel
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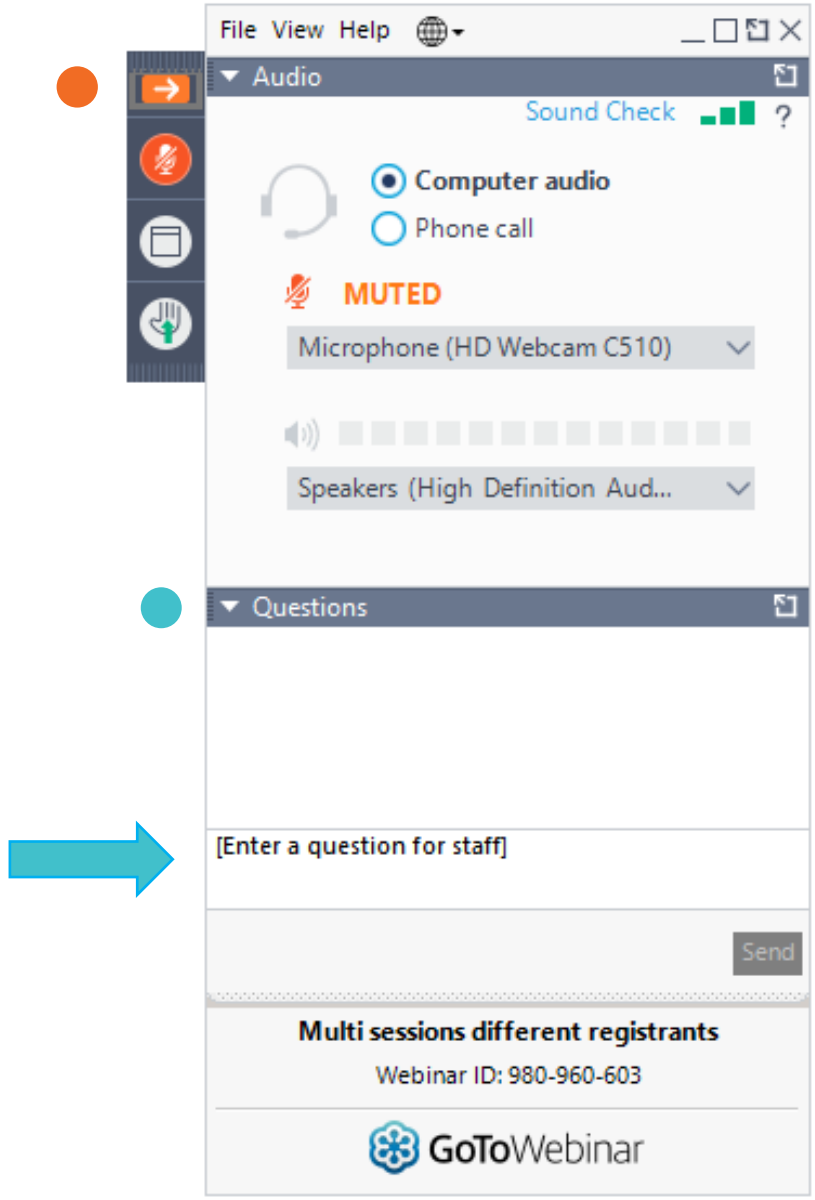

# Medistim ASA Q3 2021

October 22nd 2021


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PRESIDENT & CEO

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# 01 Highlights

# Highlights 3rd Quarter

| | Q3 2021 | Q o Q |
|---|---|---|
| **Revenue** | MNOK 102.1 (83.4) | +22.5 % |
| **EBIT** | MNOK 25.1 (20.8) | +20.3 % |
| **Currency** | | - 8.1 % |

**Number of units sold or outplaced:**

| | | |
|---|---|---|
| Flow systems | 30 | 0 % |
| Imaging systems | 17 | +70 % |
| Flow probes (ex USA) | 1 996 | **+50.9 %** |
| Imaging probes | 38 | +137.5 % |
| Procedures (USA) | 18 822 | **+28.9 %** |

## 3rd quarter in a row with sales over MNOK 100

- **First time a 3rd quarter is above MNOK 100 in sales revenues**
  - **Imaging sales up 43.5%** in NOK, **Flow** sales up 16.3% in NOK
  - **Vascular sales up 57.0%** in NOK, **Cardiac** sales up 17.9 %in NOK
  - **Currency neutral growth** was 30.6% in total and **33.0% for own products:**
    - USA up 24.9%, Europe up 39.3%, Asia up 27.8%, RoW up 126%
- **Third-party** products grow by 19.0 %

## Solid EBIT growth with margin at 24.6%

# Highlights YTD September

| | YTD 2021 | YTD o YTD |
|---|---|---|
| **Revenue** | MNOK 314.5 (268.9) | +17.0 % |
| **EBIT** | MNOK 96.8 (73.3) | + 32.0 % |
| **Currency** | | - 7.5 % |

**Number of units sold or outplaced:**

| | | |
|---|---|---|
| Flow systems | 104 | - 8.0 % |
| Imaging systems | 68 | + 51.1 % |
| Flow probes (ex USA) | 5 727 | **+ 28.7 %** |
| Imaging probes | 104 | + 36.8 % |
| Procedures (USA) | 54 211 | **+ 28.6 %** |

## Best YTD September ever for revenue and EBIT

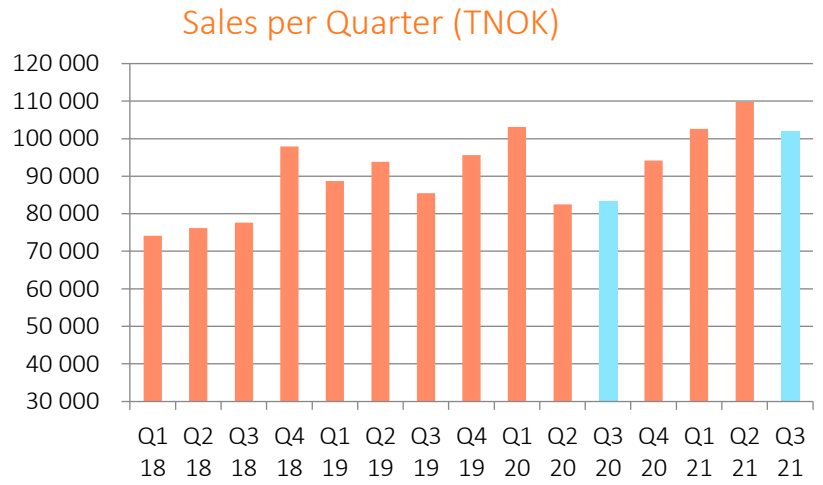
- **Sales revenue YTD September is up 15% to MNOK 309.2**
  - **Imaging** sales up 23.2%, Flow up 11.9% in NOK
  - **Vascular** sales up 10.1 %, Cardiac up 14.4% in NOK
  - **Currency neutral growth was** 24.5% in total and **25.3% for own products:**
    - USA up 23.3%, Europe up 25.1%, Asia up 28.3%, RoW down 9.7%
- **Total revenue YTD September is up 17% to MNOK 314.5,** 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 20.8 %

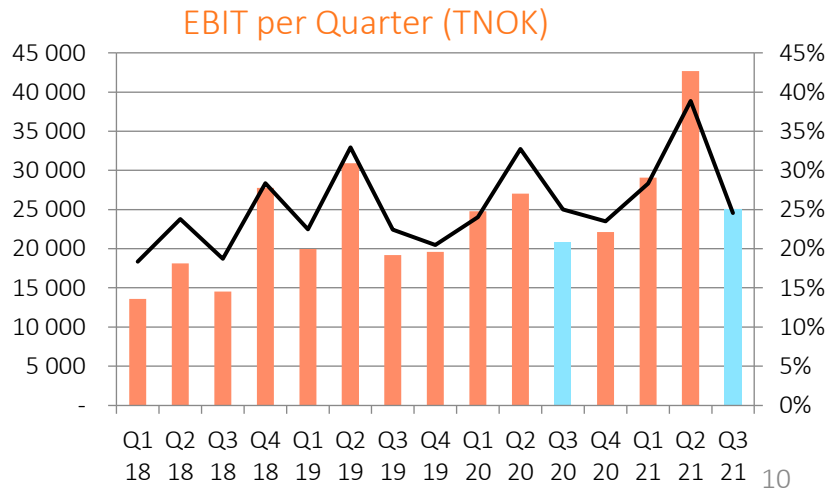
EBIT YTD September of MNOK 96.8 is higher than for the full year of 2020 (MNOK 95.5)

# 02 Financial Statements

# Profit and loss Q3 2021

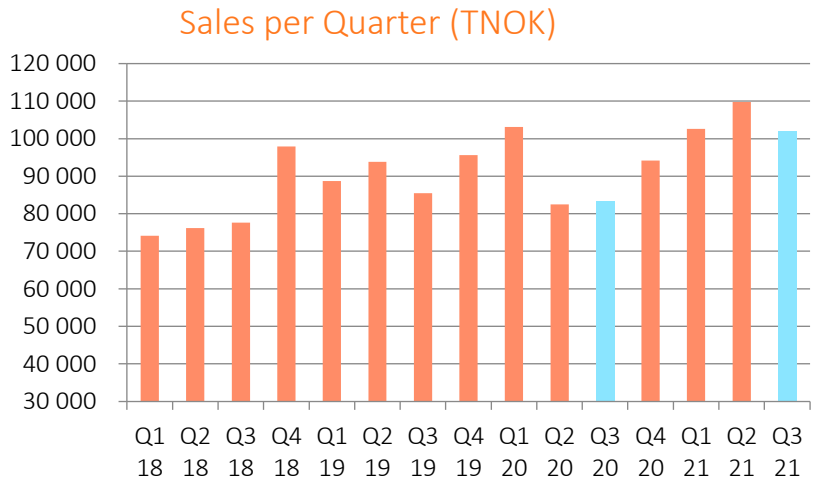
| Profit & loss | Q3 2021 | Q3 2020 |
|---|---|---|
| *All numbers in NOK 1000* | | |
| **Sales revenue** | **102 138** | **83 361** |
| Other revenue | - | - |
| **Total revenue** | **102 138** | **83 361** |
| Cost of goods sold | 23 793 | 15 379 |
| Salary and social expenses | 35 478 | 31 186 |
| Other operating expenses | 11 882 | 10 170 |
| Total operating expenses | 71 152 | 56 736 |
| **Op. res. before depr. and write-offs (EBITDA)** | **30 986** | **26 625** |
| *EBITDA %* | *30,3 %* | *31,9 %* |
| Depreciation | 5 909 | 5 772 |
| **Operating result (EBIT)** | **25 077** | **20 853** |
| *EBIT %* | *24,6 %* | *25,0 %* |
| Financial income | 3 258 | 4 678 |
| Financial expenses | 4 351 | 6 864 |
| **Net finance** | -1 093 | -2 185 |
| **Pre tax profit** | **23 984** | **18 668** |
| Tax | 5 186 | 4 225 |
| **Profit after tax** | **18 798** | **14 442** |
| **Dividend** | - | - |

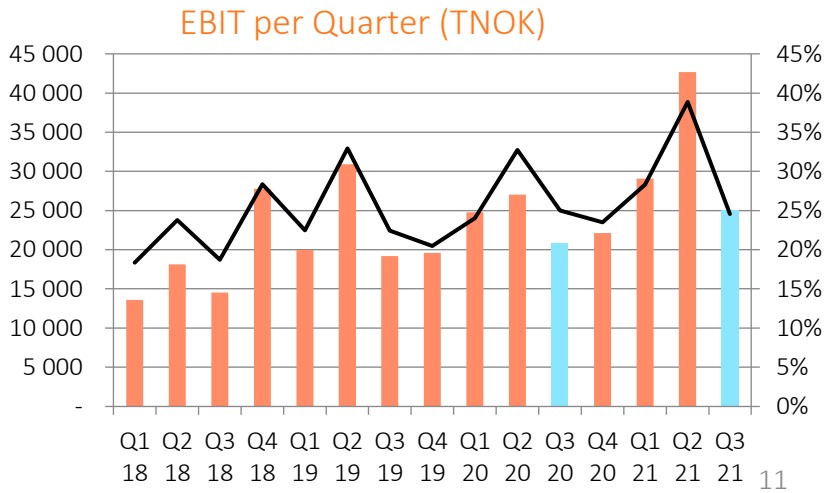


# Profit and loss YTD September 2021

| **Profit & loss** | **YTD 30.09.21** | **YTD 30.09.20** |
|---|---|---|
| *All numbers in NOK 1000* | | |
| **Sales revenue** | **309 244** | **268 949** |
| Other revenue | 5 292 | - |
| **Total revenue** | **314 536** | **268 949** |
| Cost of goods sold | 69 231 | 54 346 |
| Salary and social expenses | 93 089 | 86 889 |
| Other operating expenses | 38 000 | 37 517 |
| Total operating expenses | 200 319 | 178 752 |
| **Op. res. before depr. and write-offs (EBITDA)** | **114 217** | **90 197** |
| *EBITDA %* | *36,3 %* | *33,5 %* |
| Depreciation | 17 400 | 16 848 |
| **Operating result (EBIT)** | **96 817** | **73 348** |
| *EBIT %* | *30,8 %* | *27,3 %* |
| Financial income | 6 509 | 12 704 |
| Financial expenses | 8 670 | 14 367 |
| **Net finance** | -2 161 | -1 663 |
| **Pre tax profit** | **94 656** | **71 686** |
| Tax | 19 869 | 15 867 |
| **Profit after tax** | **74 788** | **55 818** |

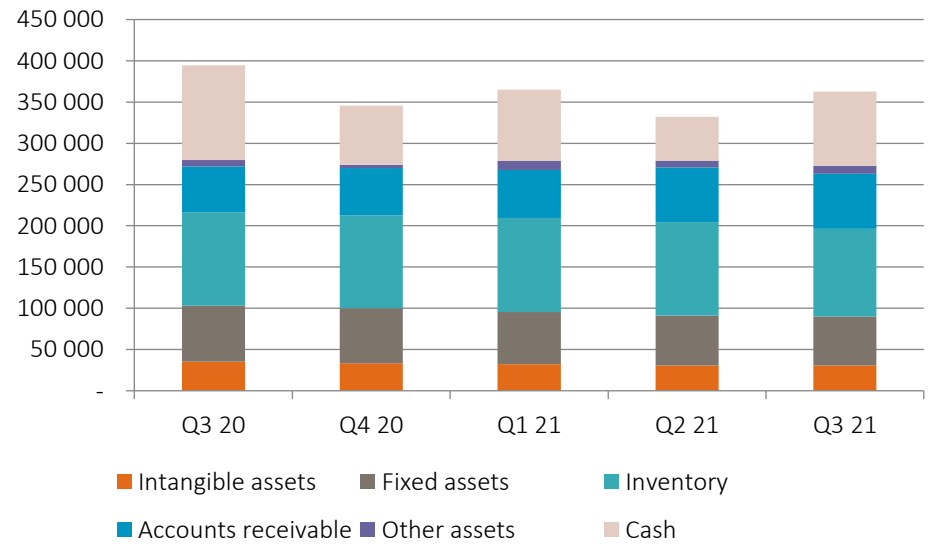


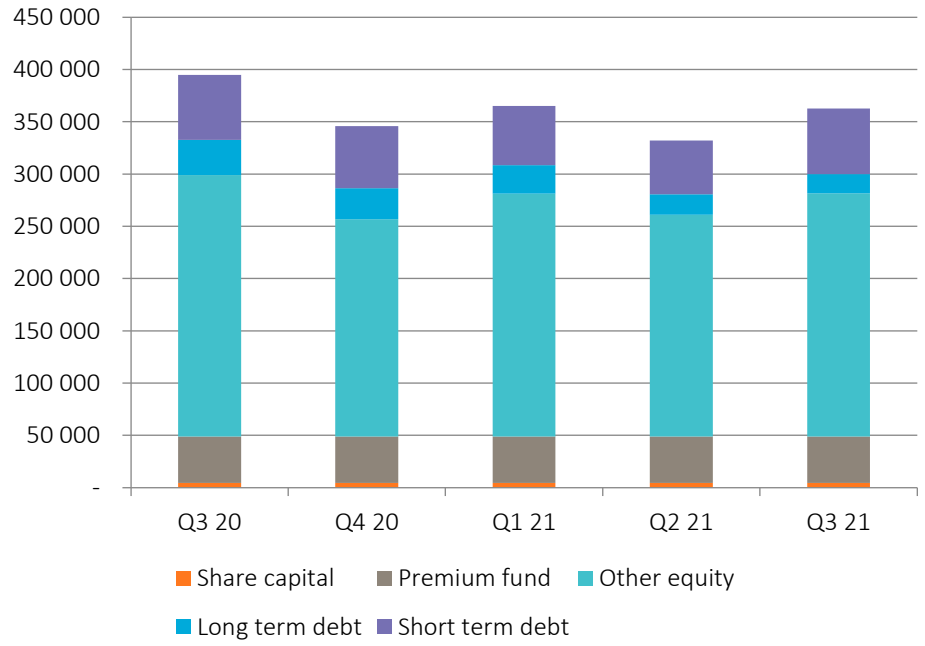
# Balance sheet – Assets

- Cash position by end of quarter was MNOK 89.6
- Securing end-of-life components and keeping security stocks of components explain the high inventory level
- A dividend of NOK 3.00 per share, total MNOK 54.6, was paid in May

| Balance sheet | 30.09.2021 | 31.12.2020 |
|---|---|---|
| *All numbers in NOK 1000* | | |
| **Assets** | | |
| Intangible assets | 30 643 | 33 464 |
| Fixed assets | 59 406 | 66 570 |
| **Total intangible and fixed assets** | **90 048** | **100 034** |
| Inventory | 106 128 | 112 667 |
| Customers receivables | 66 907 | 57 485 |
| Other receivables | 9 847 | 3 744 |
| Cash | 89 658 | 71 891 |
| **Total current assets** | **272 540** | **245 786** |
| **Total assets** | **362 588** | **345 820** |



| Balance sheet | 30.09.2021 | 31.12.2020 |
|---|---|---|
| *All numbers in NOK 1000* | | |
| Share capital | 4 585 | 4 585 |
| Premium fund | 44 172 | 44 172 |
| Other equity | 232 907 | 208 089 |
| **Total equity** | **281 664** | **256 846** |
| **Total long term debt** | **18 339** | **29 497** |
| **Total short term debt** | **62 585** | **59 477** |
| **Total equity and liability** | **362 588** | **345 820** |



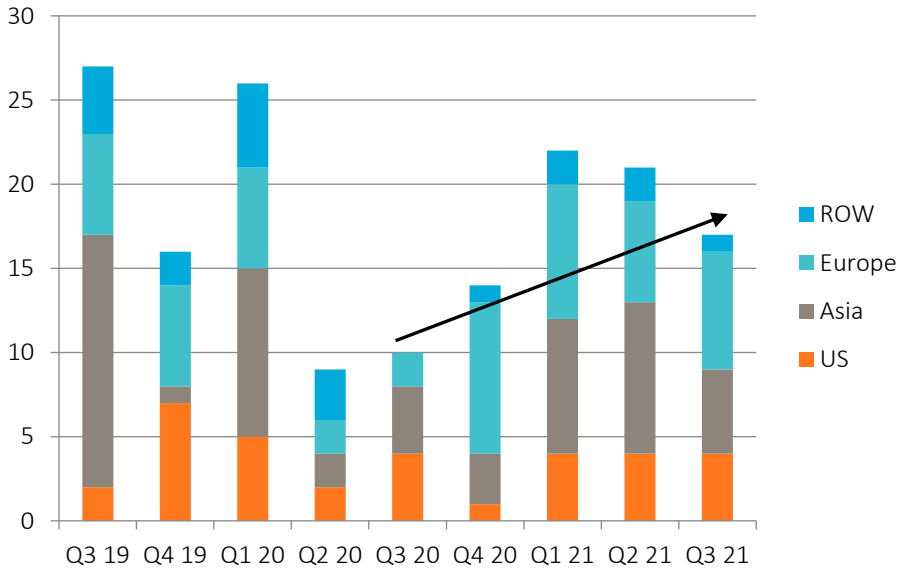

# Balance sheet – Equity and Liability

- 2.25 MNOK in interest-bearing debt
- 23.3 MNOK in obligations related to lease contracts where 16.4 MNOK is long term
- Strong balance sheet with 77.7 % equity ratio

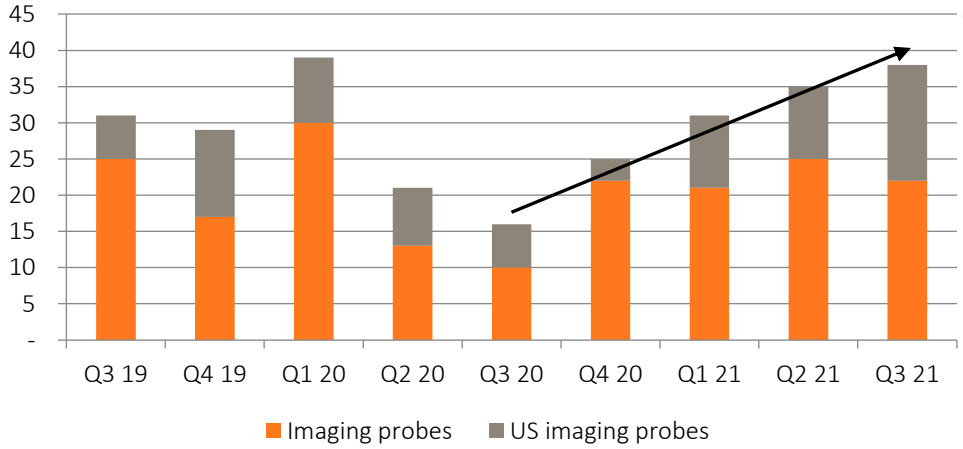
# 03 Business segments update

# Imaging probes and systems in units

## Imaging systems in units




## Imaging probes in units

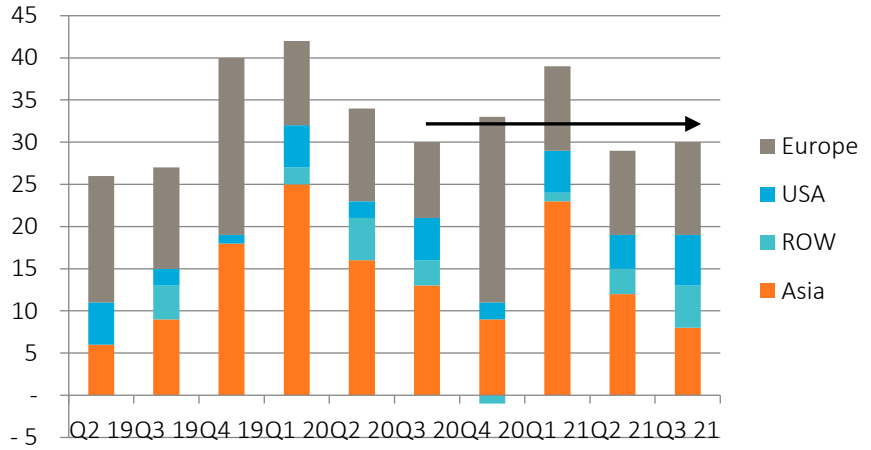



- Unit sales of imaging systems sold as capital equipment continue to be strong after the COVID slow down, **growing 70%** this quarter
- Unit sales of imaging probes are also back to normal, **growing 137.5%** this quarter

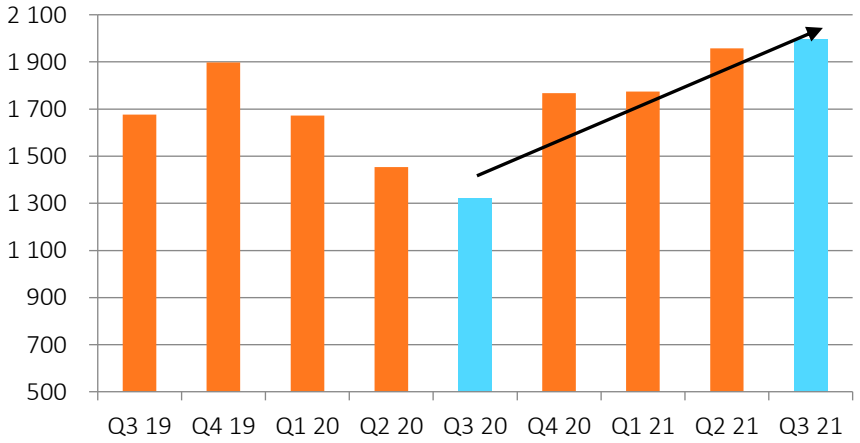
# Flow probes and systems in units

- Number of flow systems sold as capital equipment is **flat** from Q3 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 7 units or **17.5%**
- 50.9% growth in number of flow probes sold this quarter reflects that the surgical **activity level is getting back to normal**

## Flow systems in units (MiraQ capital sales)




## Flow probes in units (excl USA)




# Revenue performance by region

| Mill NOK | Q3 21 | Q3 20 | Q / Q | YTD 21 | YTD 20 | YTD / YTD | 2020 |
|---|---|---|---|---|---|---|---|
| **Europe** | 45,8 | 35,9 | 27,4 % | 140,8 | 117,4 | 19,9 % | 173,3 |
| **USA** | 38,5 | 34,5 | 11,8 % | 115,0 | 99,4 | 15,7 % | 126,4 |
| **Asia** | 13,2 | 10,8 | 22,0 % | 46,5 | 38,0 | 22,4 % | 46,8 |
| **ROW** (MEA, CAN, SA, AUS) | 4,6 | 2,1 | 116,4 % | 12,2 | 14,1 | -13,8 % | 16,7 |
| **Total** | **102,1** | **83,4** | **22,5 %** | **314,5** | **268,9** | **17,0 %** | **363,1** |

- In Europe, Q3 sales of **own products increased** with 33.0% in NOK and 39.3% currency neutral. YTD September, sales of own products increased with 19.4% in NOK and 25.1% currency neutral. **3. party increased** with 19% in Q3 and 20.8% YTD.
- In the USA, currency neutral sales for the quarter increased with 24.9%. Total revenues YTD include the extraordinary MNOK 5.3 related to the U.S. Paycheck Protection Program. When excluding this, sales revenue YTD was NOK 109.8, a 10.4 % increase. Currency neutral this corresponds to an increase of with 23.3 %.
- In Asia, solid growth both for the quarter and YTD.
- ROW continues to be a small sales territory for Medistim, with significant quarter to quarter variation.

*Negative currency effects for YTD 2021 vs 2020 was 20.0 MNOK .*

*Average actual exchange rate for USD 8.55 and EUR 10.23 versus last year USD 9.55 and EUR 10.72.*

# Revenue performance by product category

| Mill NOK | Q3 21 | Q3 20 | Q / Q | YTD 21 | YTD 20 | H1 / H1 | 2020 |
|---|---|---|---|---|---|---|---|
| **Procedures (USA)** | 28,4 | 25,3 | 12,2 % | 83,2 | 76,0 | 9,4 % | 99,4 |
| **Flow probes** | 30,2 | 23,4 | 28,7 % | 85,4 | 69,8 | 22,3 % | 92,6 |
| **Flow systems (MiraQ)** | 12,0 | 9,9 | 21,3 % | 33,5 | 33,8 | -0,9 % | 47,2 |
| **Imaging systems (MiraQ)** | 12,5 | 9,3 | 35,5 % | 42,8 | 34,2 | 25,1 % | 44,2 |
| **Imaging probes** | 1,6 | 0,8 | 96,0 % | 5,1 | 3,9 | 29,5 % | 5,2 |
| **3rd party** | 17,0 | 14,3 | 19,0 % | 55,9 | 46,3 | 20,8 % | 67,5 |
| **Other** | 0,5 | 0,4 | 22,6 % | 8,7 | 4,9 | 77,2 % | 6,9 |
| **Total revenues** | **102,1** | **83,4** | **22,5 %** | **314,5** | **268,9** | **17,0 %** | **363,1** |

- Procedure sale in the USA: The total number of **procedures increased with 28.9% for the quarter and with 28.6 % YTD September**. Lower % growth in NOK is explained by unfavorable currency.
- Flow probes: In units the growth is 50.9 % for the quarter and 28.7 % YTD September. The lower % growth in NOK is due to higher sales through distributors and unfavorable currency.
- Flow systems (capital): At the the same level in number of units but higher sales through direct operation increases revenue in NOK.
- Imaging systems (capital): 80% increase in capital units. The lower increase in NOK is related to high sales through distributors this quarter and currency. YTD September, the % growth in number of capital units sold is 51%. The lower increase in NOK has same explanation as for the quarter.
- 3rd party products: Strong quarter and YTD September.
- Other: Includes an **extraordinary revenue of MNOK 5.3** related to the U.S. Paycheck Protection Program

# Conclusion: We are in recovery from the COVID-19 pandemic

From gradually decreasing impact to strong recovery in 2nd and 3rd quarter 2021

## Currency neutral sales development

- → Q2-20: - 19.3 % vs LY
- → Q3-20: - 9.7 % vs LY
- → Q4-20: - 7.2 % vs LY
- → Q1-21: + 4.4 % vs LY
- → **Q2-21: + 36.7 % vs LY**
  **(strongest quarter ever)**
- → **Q3-21: + 30.6 % vs LY**

## 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

## A positive outlook

- → Increasing vaccination rates ensure capacity for cardiovascular surgery
- → Medistim remains optimistic about the future

# 04 Implementing the strategy

# Medistim growth strategy

| GEOGRAPHIES | CABG surgery (2 BNOK) | Vascular surgery (>1.5 BNOK) | Other open heart surgery (1BNOK) |
|---|---|---|---|
| **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 | |

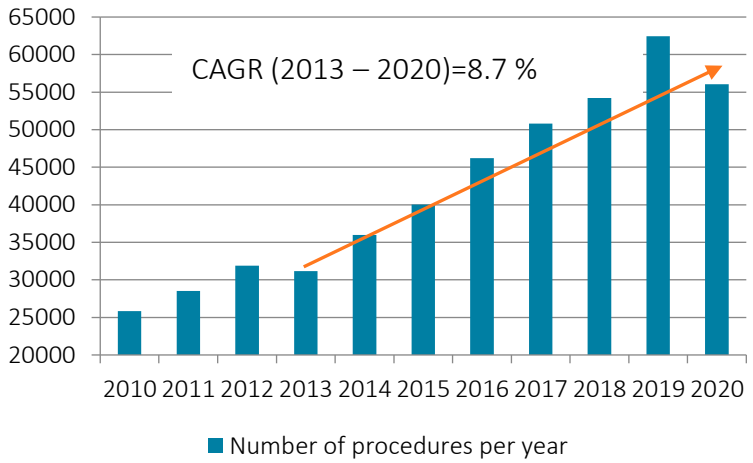
APPLICATION AREAS

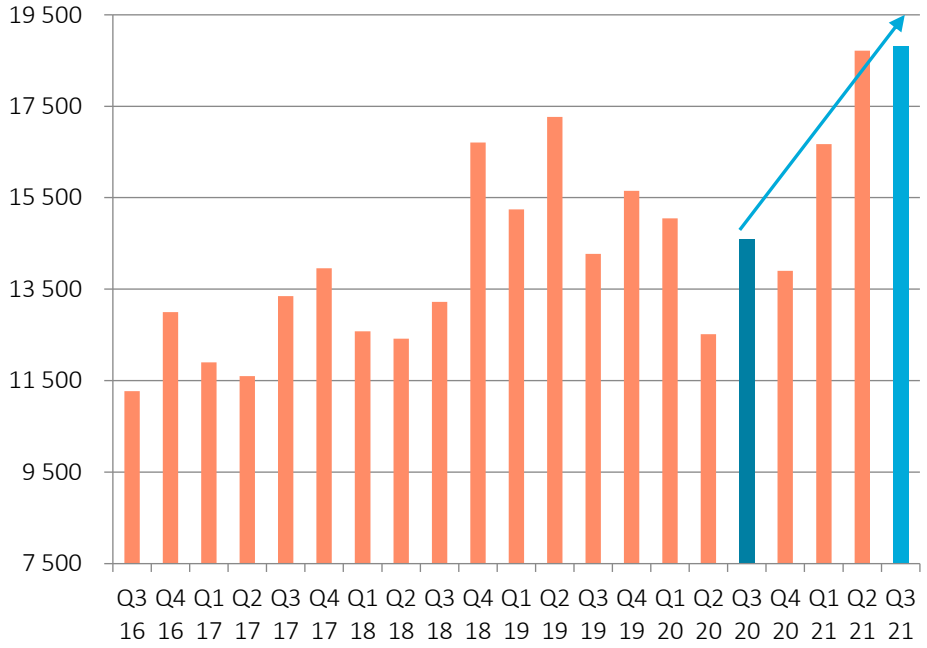
1. Convert the routine Flow market to a Flow-and-Imaging market by establishing *Surgical Guidance and Quality Assessment* as the new standard of care through
   - → Early adopter & KOL support
   - → REQUEST study
   - → Ease conversion from flow to imaging with MiraQ
2. Achieve routine use of both 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

# Sales growth in the USA

# Performance US sales

- **Currency neutral sales revenue grow by 24.9% in Q3** and by 23.3% YTD
  - Total YTD revenue in USD includes the Paycheck Protection Program revenue of TUSD 630. YTD total revenue grows by 29.2%
- Total **number of procedures** was up 28.9% in Q3 and 28.6% YTD
  - **Flow** procedures up 19.5% in Q3
  - **Imaging** procedures up 87.8% in Q3
- **Capital systems sales**:
  - 10 units in Q3 vs 9 LY
  - 27 units YTD September vs 23 LY
- **Strong growth in new customers**
  - 33 YTD September vs 18 last year



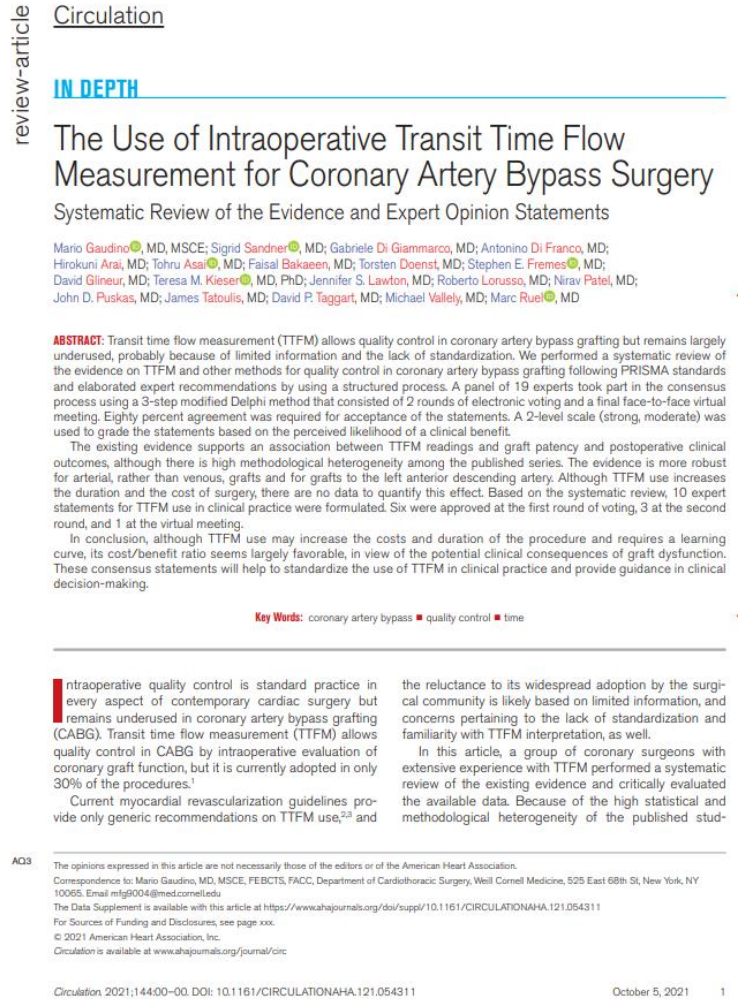

Number of procedures per quarter


# New publications

# Hot off the press: Review-article in CIRCULATION, Oct 5th 2021

- Authored by 19 cardiac surgeon experts (4 from REQUEST study) from all over the world
- Published in Circulation, one of the highest ranked journals in cardiology and cardiovascular medicine

| | 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 | 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 Gaudino, MD, MSCE; Sigrid Sandner, MD; Gabriele Di Giammarco, MD; Antonino Di Franco, MD; Hirokuni Arai, MD; Tohru Asai, MD; Faisal Bakaeen, MD; Torsten Doenst, MD; Stephen E. Fremes, MD; David Glineur, MD; Teresa M. Kieser, MD, PhD; Jennifer S. Lawton, MD; Roberto Lorusso, MD; Nirav Patel, MD; John D. Puskas, MD; James Tatoulis, MD; David P. Taggart, MD; Michael Vallely, MD; Marc Ruel, 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-

AQ3



Correspondence to: Mario Gaudino, MD, MSCE, FEBCTS, FACC, Department of Cardiothoracic Surgery, Weill Cornell Medicine, 525 East 68th St, New York, NY 10065. Email mfg9004@med.cornell.edu

The Data Supplement is available with this article at https://www.ahajournals.org/doi/suppl/10.1161/CIRCULATIONAHA.121.054311

For Sources of Funding and Disclosures, see page xxx.



*Circulation* is available at www.ahajournals.org/journal/circ

*Circulation.* 2021;144:00–00. DOI: 10.1161/CIRCULATIONAHA.121.054311 October 5, 2021 1

# “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)

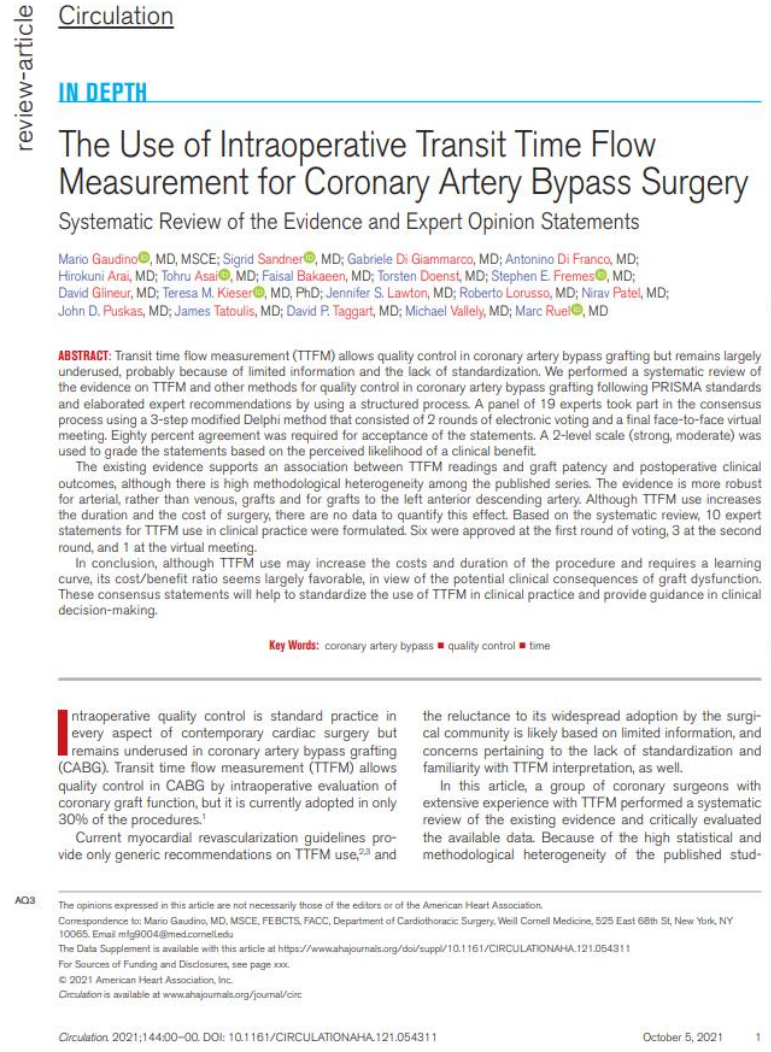
## Conclusion

- “…TTFM’s 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”

10 CONSENSUS STATEMENTS:

#1 reads:

“TTFM should be used in every CABG case”



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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 Gaudino, MD, MSCE; Sigrid Sandner, MD; Gabriele Di Giammarco, MD; Antonino Di Franco, MD; Hirokuni Arai, MD; Tohru Asai, MD; Faisal Bakaeen, MD; Torsten Doenst, MD; Stephen E. Fremes, MD; David Glineur, MD; Teresa M. Kieser, MD, PhD; Jennifer S. Lawton, MD; Roberto Lorusso, MD; Nirav Patel, MD; John D. Puskas, MD; James Tatoulis, MD; David P. Taggart, MD; Michael Vallely, MD; Marc Ruel, 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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# Several expert consensus statements published in 2021

- The **advocacy** is getting loader and more prominent
- Influencing peers; driving routine use and setting the **standard-of-care**
- Reasonable to expect new and stronger **clinical guideline endorsements**

Editorial

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

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Gregory D. Trachiotis[1], MD, Michael A. Napolitano[1,2], MD, Ethan S. Rosenfeld[1,2], MD, and David P. Taggart[3], MD, PhD

Introduction

Coronary artery bypass grafting (CAB commonly performed procedure for th geon.[1] The metrics for success of CABG on decreasing mortality, improving quali symptom severity. All of these outcomes technical success of the operation itself, tion of adequately patent bypass grafts.

While there have been many advances developed in recent years to improve clini surgery,[2] less attention has been given to th ing the technical success of the procedure in several tools are available, including tran ment (TTFM; Fig. 1), high-frequency (HFUS; Fig. 2, Fig. 3), thermal coronary an erative fluorescence imaging. In structural l echocardiography to immediately evaluat valve replacement/repair is widely accepte tice.[3,4] However, although CABG is techni ing with regards to precision, and where th distal anastomosis is <1 mm, there is no su operative quality assessment of grafts or wh should be. Furthermore, it is inconceivable cardiologist would not perform a completio ing a stent in a coronary artery, a proced demanding than a bypass graft. It is also both off-pump CABG (OPCAB) and use of which have well-defined roles in partic increase that level of technical complexity.

Perioperative graft failure may occur in 9% of patients undergoing CABG surgery. though underutilized, tool to address this qu rarely discussed "elephant outside t (Supplemental Video). The first published r CABG date back to 1994 in 2 separate publ as well as Canver and Dame.[5] Since that tim been well validated as a means of intraop ment, and from 2010 through its most rec European Society of Cardiology and Eur Cardio-Thoracic Surgery guideline

Editorial

**The 10 Commandments for Multiarterial Grafting**

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Rami Akhrass[1], MD and Faisal G. Bakaeen[1], MD

Introduction

Coronary artery bypass grafting (CABG), intro neered over 50 years ago at the Cleveland Clin Favalloro, has remained the gold standard in t multivessel coronary artery disease with heavy burden.[1] While utilizing the internal thoracic bypass the left anterior descending artery (LA cornerstone of CABG since 1986,[2] there has be sensus on the importance of multiarterial grafti the use of at least 2 arterial grafts, resulting i vival and freedom from major adverse cardiac reinterventions.[3,4] Indeed, the most recent CA set forth by the Society of Thoracic Surgeons supplementation of the ITA graft to the LAD, multivessel disease, with the use of additional I artery (RA) grafts.[5] The incremental benefit o graft has been somewhat equivocal, although of observational studies suggested better lon with 3, compared to 2, arterial grafts.[6]

The outcome advantage attained with CAB percutaneous coronary intervention is most e nounced in patients that receive at least one ITA conduits, in particular the ITA, are rarely affe sclerosis making them ideal conduits to use wit rates. The ITA has unique biological charact increased nitric oxide levels that may also expl effect on native coronary circulation that has be lowing bypass surgery.[4]

In spite of the above, in the United States, over are saphenous vein grafts (SVG) and less than undergoing CABG receive more than one arteri barriers are implicated in the lack widespread ad including increased technical complexity and op lier suboptimal results with RA use, wound heali bilateral ITA (BITA) harvesting especially in diab tion to the somewhat long latency period, us decade from index operation, until the impact of i with MAG is generally realized.[3–5]

While MAG may not be suitable to all CAB use of arterial grafts is encouraged and shou heart-team discussion in determining the opti ization strategy.[3] The strategy of revascula among patients, taking into consideration ov

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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]

The most frequently cited limitations to widespread adoption are:

(i) a lack of standardization of how TTFM should be performed;
(ii) a lack of standardization of how TTFM measurements should be interpreted, based on the concern that some grafts may be revised unnecessarily;
(iii) 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;
(iv) intraoperative quality control is not addressed in current clinical practice guidelines of any of the North American cardiovascular societies; and
(v) differences in opinion among CABG leaders exist as to when TTFM should be used.

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# 20 largest shareholders per October 19th

| Rank | Name | Holding | % of total | Citizenship | Type of account |
|---|---|---|---|---|---|
| 1 | AETERNUM CAPITAL AS | 1 862 500 | 10,16 % | Norway | Ordinary |
| 2 | VERDIPAPIRFOND ODIN NORDEN | 1 800 000 | 9,82 % | Norway | Ordinary |
| 3 | INTERTRADE SHIPPING AS | 1 285 000 | 7,01 % | Norway | Ordinary |
| 4 | State Street Bank and Trust Comp | 1 238 675 | 6,75 % | United States | Nominee |
| 5 | State Street Bank and Trust Comp | 1 103 921 | 6,02 % | United States | Nominee |
| 6 | Skandinaviska Enskilda Banken AB | 1 029 728 | 5,62 % | Sweden | Nominee |
| 7 | FOLLUM CAPITAL AS | 970 000 | 5,29 % | Norway | Ordinary |
| 8 | State Street Bank and Trust Comp | 616 154 | 3,36 % | United States | Nominee |
| 9 | Skandinaviska Enskilda Banken AB | 598 092 | 3,26 % | Denmark | Nominee |
| 10 | State Street Bank and Trust Comp | 466 805 | 2,55 % | United States | Nominee |
| 11 | Skandinaviska Enskilda Banken AB | 409 723 | 2,23 % | Sweden | Nominee |
| 12 | SKANDINAVISKA ENSKILDA BANKEN AB | 387 682 | 2,11 % | Luxembourg | Nominee |
| 13 | FD INVT TR: FD SRS INTL SML CP FD | 382 845 | 2,09 % | United States | Ordinary |
| 14 | BUANES | 379 936 | 2,07 % | Norway | Ordinary |
| 15 | The Bank of New York Mellon SA/NV | 257 500 | 1,40 % | Denmark | Nominee |
| 16 | Skandinaviska Enskilda Banken AB | 238 314 | 1,30 % | Sweden | Nominee |
| 17 | BNP Paribas Securities Services | 233 392 | 1,27 % | Italy | Nominee |
| 18 | Euroclear Bank S.A./N.V. | 232 559 | 1,27 % | Belgium | Nominee |
| 19 | Danske Invest Norge Vekst | 228 000 | 1,24 % | Norway | Ordinary |
| 20 | The Bank of New York Mellon SA/NV | 210 931 | 1,15 % | Ireland | Nominee |

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