SUDDEN CARDIAC DEATH

Canadian Cardiovascular Society/Canadian Heart Rhythm Society position paper on implantable cardioverter defibrillator use in Canada

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The Canadian Heart Rhythm Society in conjunction with the Canadian Cardiovascular Society is committed to the promotion of evidence-based practice in Canada. Since the last Canadian guidelines on the management of sudden cardiac death were published in 2000, several well-conducted clinical trials evaluating the implantable cardioverter defibrillator have been completed and published. The Canadian Cardiovascular Society Council has granted permission to review and update guidelines for the indications for implantable cardioverter defibrillators. Furthermore, data are emerging on the potential benefits of biventricular pacing therapy (cardiac resynchronization) for heart failure; recommendations for the use of this therapy have been included in the present paper. Ethical considerations and the economic implications of these recommendations are also included. Canada’s heart rhythm specialists, represented by the Canadian Heart Rhythm Society, have been joined by two heart failure specialists, a medical ethicist and an economist, to develop the present position paper. Members of the Canadian Heart Rhythm Society participated in the discussion of these recommendations in open forum meetings and by electronic communication.

Key Words: ICD; Sudden death

Each year, more than 40,000 Canadians die from a cardiovascular cause. Approximately one-half of these deaths are sudden, and they are usually due to the development of fatal ventricular arrhythmias. Implantable cardioverter defibrillators (ICDs) are life-saving in selected patients at high risk of sudden cardiac death (SCD) and have been the subject of previous national guidelines (Canadian Cardiovascular Society, American College of Cardiology/American Heart Association, North American Society for Pacing and Electrophysiology) (1,2). The recommendations from these guidelines focused mainly on secondary prevention of sudden death after a nonfatal ventricular arrhythmia, with fewer recommendations directed at primary prevention based on the literature available at that time. Since then, important new information has become available in the area of primary prevention of SCD, which forms the basis of the updated recommendations for ICD use in the present paper.

Evidence for ICD benefit in patients with a previous occurrence of sustained ventricular arrhythmia (secondary prevention)

Three large randomized studies have compared the use of an ICD with antiarrhythmic drug therapy (primarily amiodarone) in patients with a history of life-threatening ventricular arrhythmias (3-5). The largest of these studies, the

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Antiarrhythmics versus Implantable Defibrillators (AVID) study, demonstrated a statistically significant decrease in mortality associated with the use of an ICD (4). The other two studies (3,5) showed trends in the same direction. A subsequent meta-analysis estimated a 27% relative reduction of all-cause mortality with ICD use (6). These studies form the basis of recommendations for ICD use in patients after a nonfatal episode of sustained ventricular arrhythmia not associated with a reversible cause found in the present paper and in previous guidelines (1,2). However, the translation of this knowledge to clinical practice has been inadequate; in a recent review of 454 SCD patients who survived to hospital discharge in Ontario, only 58 (12.8%) received an ICD (7).

Subgroup analyses of these secondary prevention trials have suggested that most, if not all, of the benefit of ICD therapy for the prevention of all-cause mortality in patients who have experienced a sustained ventricular tachyarrhythmia is enjoyed by patients with a left ventricular ejection fraction (LVEF) of 35% or less (6).

Evidence for ICD benefit in high-risk patients without a prior history of sustained ventricular arrhythmia (primary prevention)

Ten randomized studies have evaluated the efficacy of an ICD to decrease the risk of death in patients thought to be at high risk of a life-threatening ventricular arrhythmia that has not yet been expressed. The entrance/exclusion criteria and principal results are summarized in Tables 1 and 2, respectively. A recent meta-analysis of these studies reports a 25% relative reduction and a 7.9% absolute reduction in all-cause mortality over an average follow-up of two to four years with ICD treatment in these trials (8). Four studies were negative, while six studies demonstrated benefit with ICD use. The negative studies were smaller and tended to study patient populations immediately after an acute event. For example, the Coronary Artery Bypass Graft Patch (CABG-Patch) trial (9), the Defibrillator in Acute Myocardial Infarction Trial (DINAMIT) (10) and the Cardiomyopathy Trial (CAT) (11) recruited patients shortly after an acute event. For example, the Coronary Artery Bypass Graft (CABG) trial (9), the Multicenter Unsustained Tachycardia Trial (MUSTT) (32,2002) and the Defibrillator in Acute Myocardial Infarction Trial (DINAMIT) (10) and the Cardiomyopathy Trial (CAT) (11) recruited patients shortly after an acute event. For example, the Coronary Artery Bypass Graft (CABG) trial (9), the Multicenter Unsustained Tachycardia Trial (MUSTT) (32,2002) and the Defibrillator in Acute Myocardial Infarction Trial (DINAMIT) (10) and the Cardiomyopathy Treatment Evaluation (DEFINITE) (14) trial (Tables 1 and 2).

The results of the SCD-HeFT (12) and the Multicenter Automatic Defibrillator Implantation Trial (MADIT and MADIT-II) (15,16) indicated that ICD therapy is associated with a reversible cause found in the present paper and in previous guidelines (1,2). However, the translation of this knowledge to clinical practice has been inadequate; in a recent review of 454 SCD patients who survived to hospital discharge in Ontario, only 58 (12.8%) received an ICD (7).
with greater benefit in patients with more severe LV dysfunction. Although SCD-HeFT included patients with an LVEF of less than 35%, the majority of patients had an LVEF of less than 30%, and subgroup analysis suggested that the benefit of ICD therapy was limited to this group. MADIT-II (16) only included patients with more severe LV dysfunction (LVEF of 30% or less). Thus, current data suggest that patients with more severe LV dysfunction derive the greatest benefit from ICD therapy irrespective of the underlying etiology of their structural heart disease.

It is important to consider that the absolute benefit from ICD therapy with respect to all-cause mortality depends on both the RR reduction from the ICD (approximately 25% to 30% risk reduction for the group as a whole) and the relevant population absolute mortality rate. The benefit will be greater if the absolute mortality is greater, even if the relative risk reduction is the same. Previous trials have demonstrated that QRS duration is a marker of a higher risk of mortality in patients with LV systolic dysfunction. Subgroup analyses of MADIT-II (16) and SCD-HeFT (12) have also suggested that the absolute benefit of ICD therapy may be greater in patients with ischemic heart disease and a wide QRS complex. Some authorities have accepted the use of a wide QRS to select patients with a potential for greater absolute benefit from an ICD, but others have rejected this notion. Additional criteria that could potentially be used to further stratify patients into lower and higher benefit groups include clinical parameters, other electrocardiogram measurements, and newer technologies such as microvolt T wave alternans measurement and heart rate variability determination. The ultimate role of these criteria, which are meant to further stratify patients for ICD benefit, will depend on the results of future studies.

It must be noted that the recommendations in the present paper reflect the current state of knowledge, based on published literature. Subgroup analyses may lead to reasonably derived hypotheses which, if proven, could lead to revisions of these recommendations. The current inclusion of any group in a class I recommendation should not impede further investigation that seeks to further refine subgroups which may derive most or potentially all of the benefit.

**FACTORS TO CONSIDER WHEN APPLYING ICD RECOMMENDATIONS**

Do the patient’s characteristics correspond to the inclusion criteria of trials showing patient benefit? All of the clinical trials mentioned above had important exclusion criteria. The following patient groups were not included in these trials: patients with significant comorbidity, such as advanced cerebrovascular disease or renal failure; patients with a predicted life expectancy of less than one year; patients for whom a revascularization procedure was planned; and patients with very severe heart failure symptoms (NYHA class IV). Furthermore, patients with no heart failure symptoms with usual activity (NYHA class I) are also under-represented in these trials.

In addition, most of the trials excluded patients during the recovery period of an acute event (acute myocardial infarction) or intervention (revascularization). The DINAMIT study (10) and secondary (post hoc) analyses of the MADIT II study (16) indicate that patients do not benefit from ICDs early after myocardial infarction (within 40 days in the DINAMIT study) (17). Therefore, in the case of a patient who is recovering from a recent myocardial infarction or revascularization procedure, adequate medical therapy should be utilized for at least one month before the determination of LVEF and assessment of the appropriateness of ICD therapy.

It is important to note that each patient’s LVEF, a central criterion with respect to all prophylactic trials of ICDs, must be measured quantitatively. A qualitative echocardiographic estimate of LVEF is insufficient to assess the suitability of a patient for prophylactic ICD implantation.

Patients younger than 18 years of age were not included in any of these trials. When applying ICD recommendations to such young patients, the potential benefits (which are often magnified in conditions when presentation at a young age identifies higher risk and when a longer exposure to sudden...
death risk in the absence of comorbid conditions may be anticipated should be balanced against the increased complication rates of ICD therapy in young, small, active and growing patients (18). Octogenarians were either excluded or under-represented in these trials (see Table 1). Therefore, the results of these trials may not be applicable to them.

Is the patient receiving optimal therapy for heart failure and his or her underlying disease?

In the clinical trials demonstrating benefit from prophylactic ICDs, patients were uniformly treated with state-of-the-art therapies for heart failure, including angiotensin-converting enzyme inhibitors and/or angiotensin receptor blockers, beta-blockers, 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors, and spironolactone when indicated. Furthermore, the majority of patients with coronary artery disease had prior revascularization. It is not appropriate to implant a defibrillator until all of these therapies are considered and applied, if indicated and well-tolerated. Of note, drug therapies should be administered at their 'evidence-proven doses'.

Is the patient fully informed about the risks and benefits of ICD therapy?

ICDs are not innocuous; their use can expose the patient to potential complications. A combined analysis of the results of randomized ICD trials that have reported on ICD complications in over 2000 patients indicates a risk of early lead dislodgement of 2.3%, a risk of early ICD system infection of 1.9%, a risk of pneumothorax of 0.6%, a risk of device malfunction of 0.5%, a risk of serious bleeding of 0.4%, a risk of venous thrombosis of 0.2%, and a risk of cardiac perforation of 0.1% (19). Furthermore, approximately 20% of ICD recipients will experience an inappropriate shock on follow-up — usually as a consequence of sinus tachycardia or atrial fibrillation.

These potential nonfatal ICD therapy complications must be weighed against the absolute benefit of ICD therapy for the prevention of all-cause mortality, which is in the order of 1.5% to 3.0% per year. When a patient has been identified as a potential candidate for an ICD, the patient should be referred to an ICD centre for 'consideration of an ICD' without fostering undue patient expectations.

ECONOMICS

Evaluations addressing the cost-effectiveness of ICDs for secondary prevention can be divided into decision analytical models and trial-based analyses. Early decision analytical models were relatively consistent, with cost-effectiveness estimates ranging from $37,000 to $51,000 (20,21).

Two recent trial-based evaluations in secondary prevention (the Canadian Implantable Defibrillator Study [CIDS] and the AVID study) calculated cost-effectiveness estimates in the $98,000 to $237,000 per life-year gained range (Canadian dollars, 2004) (22,23). The only published trial-based analysis of the cost-effectiveness of ICD therapy in primary prevention is that of the MADIT trial, which estimated a cost-effectiveness of $39,000 per life-year gained (Canadian dollars, 2004) (24). In decision analytical modelling studies (24,25), cost-effectiveness estimates for primary prevention ICDs ranged from $47,000 to $317,000 per life-year gained (Canadian dollars, 2004). For the MADIT-II (16) population, arguably the best representation of primary prevention patient selection in Canada at the present time, a recent technology assessment document for a major insurance company (25) estimated a cost-effectiveness of $37,000 (United States dollars, currency value at the time of writing) per life-year gained, or $51,000 (United States dollars, currency value at the time of writing) per quality-adjusted life-year gained. These estimates are critically influenced by the cost of the ICD, the age of the patients, the frequency of generator replacement and the estimated efficacy of the ICD for the prevention of SCD.

NEED VERSUS RESOURCE AVAILABILITY

Patients can make voluntary, informed decisions about having ICDs implanted only if ICDs are first offered to them. Whether to offer an ICD to a patient is a decision that physicians have to make, but that decision can be difficult because the number of patients who fulfill the criteria for ICD implantation is greater than the number of ICDs currently available. The scientific data that identify patients who might benefit from ICDs are rapidly evolving. The available funding tends to lag behind the demand. This discrepancy between available resources and need can lead physicians to exercise judgement in device allocation that may not be supported by scientific evidence. This kind of decision-making is problematic because of the inconsistency and arbitrariness that may result. A patient who presented in November, after the annual allocation of ICDs was exhausted, might have been offered this therapy if he or she had presented earlier in September. Economic constraints place physicians in an uncomfortable position. When they act as gatekeepers for society's health care resources, their medical duty to their patients may be compromised. In addition, economic constraints can create a culture of under-referral of appropriate patients.

An open, transparent process with disclosure of appropriate information leads to the implementation of legitimate institutional procedures and policies. Fair, consistent and objective decisions are the result. A cooperative, collaborative process that involves all stakeholders — patients, physicians, hospital administrators, program managers and ministries of health — confers legitimacy on some of the difficult decisions that must be made.

RECOMMENDATIONS FOR ICD IMPLANTATION – CANADIAN CARDIOVASCULAR SOCIETY/CANADIAN HEART RHYTHM SOCIETY GUIDELINES

In the present document, the authors adopted the American College of Cardiology/American Heart Association format for Classification of Recommendations and Level of Evidence (Table 3) as follows:

Classification of recommendations

Class I: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is useful and effective.

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.

IIa: Weight of evidence/opinion is in favour of usefulness/efficacy.

IIb: Usefulness/efficacy is less well-established by evidence/opinion.
**TABLE 3**
Classification of recommendations and levels of evidence for implantable cardioverter defibrillator (ICD) implantation

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Level of evidence</th>
<th>Factors to consider when applying recommendations to an individual patient</th>
</tr>
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<tbody>
<tr>
<td><strong>Class I recommendations</strong></td>
<td></td>
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</tr>
<tr>
<td>1. Cardiac arrest due to VF or VT not due to a transient or reversible cause.</td>
<td>A</td>
<td>Subgroup analyses assign most of the benefit of ICD therapy to patients with LVEF &lt;35%. Selected patients with LVEF &gt;35% and/or significant comorbidity may choose alternate therapy such as amiodarone.</td>
</tr>
<tr>
<td>2. Spontaneous, sustained VT in association with structural heart disease.</td>
<td>B</td>
<td>In some instances, alternative therapy may be appropriate (eg, ablation for bundle branch re-entry VT).</td>
</tr>
<tr>
<td>4. Spontaneous, sustained VT in patients who do not have structural heart disease that is not amenable to other treatments.</td>
<td>B</td>
<td>ICD may be used if pharmacological treatment and/or ablation is not feasible or has failed.</td>
</tr>
<tr>
<td>5. Patients with ischemic heart disease with or without mild-to-moderate heart failure symptoms and LVEF of 30% or less, measured at least one month postmyocardial infarction and at least three months postcoronary revascularization procedure (CABG or PCI).</td>
<td>A</td>
<td>Patients with significant comorbidities may not benefit from an ICD. The use of additional risk stratifiers, such as QRS duration and T wave alternans, are under investigation.</td>
</tr>
<tr>
<td><strong>Class IIa recommendations</strong></td>
<td></td>
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<tr>
<td>6. Patients with ischemic heart disease and LV dysfunction (LVEF 31% to 35%), measured at least one month post-myocardial infarction and three months postcoronary revascularization procedure with inducible VF/sustained VT at electrophysiology study.</td>
<td>B</td>
<td>subgroup analyses of the primary prevention trials have suggested that the relative and absolute benefits of patients in the LVEF 31% to 35% range may be smaller. An EP study may help to select higher-risk patients in this group.</td>
</tr>
<tr>
<td>7. Patients with nonischemic cardiomyopathy present for at least nine months, an LVEF of 30% or less, and NYHA functional class II to III heart failure.</td>
<td>B</td>
<td>The LVEF in most patients in the trials assessing dilated cardiomyopathic patients was very low (average 21% to 25%); therefore, patients with higher LVEF measurements were under-represented in the trials showing benefit.</td>
</tr>
<tr>
<td>8. Patients with familial or inherited conditions including but not limited to long QT syndrome, hypertrophic cardiomyopathy, Brugada syndrome or arrhythmogenic RV cardiomyopathy, and patients at a high risk of life-threatening ventricular tachyarrhythmias.</td>
<td>B</td>
<td>Factors such as family history of sudden death, inducibility of ventricular arrhythmias at EP study, patient preference and results of selected noninvasive testing may help to determine the appropriateness of ICD therapy.</td>
</tr>
<tr>
<td><strong>Class IIb recommendations</strong></td>
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<tr>
<td>9. Patients with ischemic heart disease, prior myocardial infarction, LV dysfunction (LVEF 31% to 35%) either with no inducible VF/sustained VT at EP study or without an EP study.</td>
<td>C</td>
<td>Subgroup analyses of the primary prevention trials have suggested that the relative and absolute benefits of patients in the LVEF 31% to 35% range may be smaller. An EP study may help to select higher-risk patients in this group.</td>
</tr>
<tr>
<td>10. Patients with nonischemic cardiomyopathy present for at least nine months, LV dysfunction (LVEF 31% to 35%) and NYHA functional class II to III heart failure.</td>
<td>C</td>
<td>The LVEF in most patients in the trials assessing dilated cardiomyopathic patients was very low (average 21% to 25%); therefore, patients with higher EF measurements were under-represented in the trials showing benefit.</td>
</tr>
<tr>
<td>11. Severe symptoms (eg, syncope) attributable to sustained ventricular tachyarrhythmias while awaiting cardiac transplantation.</td>
<td>C</td>
<td>An ICD in this circumstance may be regarded as a ‘bridge’ to transplantation. Antiarhythmic therapy may be regarded as a reasonable alternative in some cases.</td>
</tr>
<tr>
<td><strong>Class III recommendations</strong></td>
<td></td>
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</tr>
<tr>
<td>12. Syncope of undetermined cause in a patient without structural heart disease.</td>
<td>C</td>
<td>Efforts should be made to rule out syncope due to inherited electrical heart disease, particularly in patients with a family history of sudden death.</td>
</tr>
<tr>
<td>13. Incessant VT or VF.</td>
<td>C</td>
<td>An ICD may become appropriate if another treatment renders VF or VT nonincessant.</td>
</tr>
<tr>
<td>14. VF or VT resulting from arrhythmias due to a transient or reversible disorder (eg, AMI, electrolyte imbalance, drugs, trauma), or amenable to surgical or catheter ablation (eg, RV outflow tract VT, idiopathic LV tachycardia).</td>
<td>C</td>
<td>Recognizing the difficulty in identifying that VT/VF is due to a reversible cause, mild electrolyte abnormalities and small troponin rises may be insufficient evidence to withhold ICD therapy.</td>
</tr>
<tr>
<td>15. Significant psychiatric illnesses that may be aggravated by device implantation or may preclude systematic follow-up.</td>
<td>C</td>
<td>A formal psychiatric assessment may be helpful in cases where the potential impact of an ICD on a psychiatric condition is uncertain.</td>
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Continued on next page
Terminal illnesses with a projected life expectancy of less than one year. Such patients were excluded from all ICD trials.

**Level of Evidence B:**
Class IIa recommendations (continued)

**RECOMMENDATION FOR CARDIAC RESYNCHRONIZATION THERAPY**

Heart failure is a significant health problem in Canada. There are over 500,000 Canadians living with this condition, and heart failure is the most frequent cause of hospitalization in those over 65 years of age. Quality of life is frequently impaired in patients with heart failure. The impact of heart failure therapies on quality of life is an important component of therapeutic efficacy.

Recent clinical trials in patients with heart failure have shown improved quality of life, heart failure symptoms (NYHA class) and exercise capacity with cardiac resynchronization therapy (CRT) devices (26-28). Improvements in quality of life with CRT devices appear to be more than what has been found with medical therapies for heart failure, although a significant proportion of this benefit may be placebo effect.

A recent meta-analysis of nine CRT trials that included 3216 patients demonstrated a 21% reduction in all-cause mortality (95% CI 4% to 24%) with CRT compared with that of controls (29). In these nine trials, the absolute risk of death was reduced by 4.2% over the course of three to 12 months of therapy. This translates into a need to treat 24 individuals to save one life over this time period. The reduction in mortality was largely related to a lower risk (40% relative reduction) of death from progressive heart failure. The impact of a combined CRT/ICD device would be anticipated to be greater than that of a CRT/pacemaker alone due to the risk of serious arrhythmias in these patients. In the Comparison of Medical Therapy, Pacing, and Defibrillation in Heart Failure trial, a combined CRT/ICD device reduced mortality by 36% (7% absolute) when compared with medical therapy alone (13). This reduction was somewhat larger than that observed for a CRT/pacemaker versus optimal medical therapy (24% relative reduction and 4% absolute reduction). The relative benefit of a CRT/ICD versus an ICD alone is unknown and is the subject of ongoing randomized trials.

It is important to recognize the limitations of current data related to CRT. The majority of CRT studies have been based on limited (three to 12 month) follow-up (29). Most CRT trials have been restricted to patients in sinus rhythm with severe heart failure symptoms (NYHA class III and IV), with an LVEF of 35% or less, and with QRS durations of at least 130 ms. It is unclear whether the efficacy of CRT is similar in patients with chronic atrial fibrillation or in patients with more narrow QRS durations. While recent data indicate that CRT may be efficacious in patients with mechanical dyssynchrony regardless of QRS duration (30), long-term randomized data are required before this therapy can be recommended in these patients. All but one of the published CRT trials randomized patients after successful device implantation. In addition, these trials used clinical data only when patients were successfully followed for a period of time. Therefore, these results may overestimate the potential benefit of CRT. Data indicate that while most (75% to 80%) of the patients who receive CRT show clinical benefit in terms of NYHA symptoms, up to one-third of patients who receive an inactive CRT system also show clinical benefit (27,28). Thus, the rate of CRT response after adjusting for this placebo effect may be less than 50%.

CRT is resource-intensive and not without risk. Based on 18 studies that included a total of 3701 patients with CRT devices, the average implant success rate was 90%, and 0.4% of patients died during implantation (29). Over a median six-month follow-up, 9% of LV leads dislodged, and mechanical malfunctions occurred in 7% of CRT recipients. These rates of device malfunction are higher than the rates observed for non-CRT pacemakers or ICD systems. The cost of CRT is also substantial. A recent cost analysis found that CRT was associated with a median incremental cost of US$107,800 per additional quality-adjusted life-year. This median incremental cost was sensitive to changes in key variables such as comorbid illness, suggesting that CRT should not be considered in patients with a comorbid illness that shortens life expectancy (31).

**Class Ia recommendation**

Patients with ischemic or nonischemic LV dysfunction, in sinus rhythm, with NYHA functional class III to IV heart failure symptoms despite optimal medical therapy, with a left ventricular end-diastolic dimension greater than 60 mm, with an

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**TABLE 3 – CONTINUED**

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<tr>
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<th>Level of evidence</th>
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<tbody>
<tr>
<td><strong>Class III recommendations (continued)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Terminal illnesses with a projected life expectancy of less than one year.</td>
<td>C</td>
<td>Such patients were excluded from all ICD trials.</td>
</tr>
<tr>
<td>17. NYHA class IV congestive heart failure in patients who are not expected to improve with any further therapy and who are not candidates for cardiac transplantation.</td>
<td>C</td>
<td>A CRT/ICD in highly selected patients with ‘end stage’ heart failure may be considered to be appropriate on the grounds that the CRT/ICD may improve the prognosis.</td>
</tr>
</tbody>
</table>

*It is recognized that each of these Class I recommendations includes a broad group of patients. Subgroup analyses have suggested that some may not benefit from an ICD. The decision to implant an ICD in any given patient must be individualized. AMI Acute myocardial infarction; CABG Coronary artery bypass graft; CRT Cardiac resynchronization therapy; EP Electrophysiology; LVEF Left ventricular ejection fraction; NYD Not yet diagnosed; NYHA New York Heart Association; PCI Percutaneous coronary intervention; RV Right ventricular; VF Ventricular fibrillation; VT Ventricular tachycardia*
LV EF of 35% or less, and with a QRS of at least 130 ms can be considered for CRT therapy. (Level of Evidence A).

In patients with ICD and CRT indications, a combined ICD/CRT device should be considered.

Currently, there is insufficient information to make recommendations for patients who otherwise meet the above criteria but have chronic persistent atrial fibrillation or for those who are on the waiting list for cardiac transplantation. Patients with narrow QRS with other evidence of ventricular dyssynchrony based on echocardiography may benefit from CRT, but the data are currently insufficient to recommend CRT. There are also insufficient data to make recommendations for patients with NYHA class II symptoms.

APPENDIX: The following Canadian cardiac electrophysiologists contributed to this position paper: S Connors, Memorial University, St John’s, Newfoundland; M Basta, M Gardner, R Parkash, J Sapp, Dalhousie University, Halifax, Nova Scotia; J E Blier, J Champagne, M Gilbert, F Molin, O G’Hara, F Philippe, Quebec Heart Institute, Sainte-Foy, Quebec; F Ayala-Paredes, F Scazzuso, Université de Sherbrooke, Sherbrooke, Quebec; P Costi, B Coutu, Pavillon Notre Dame, Université de Montréal, Montréal, Quebec; M Dubuc, P Guerra, C Guimond, P Lacombe, L Macle, D Roy, M Talajic, B Thibault, Montréal Heart Institute, Montreal, Quebec; M Rosengarten, M Sami, McGill University, Montreal, Quebec; D Binnie, M Collo, M Green, R Lemen, A Tang, University of Ottawa Heart Institute, Ottawa, Ontario; R Gow, Children’s Hospital of Eastern Ontario, Ottawa, Ontario; H Abdollah, C Simpson, G Veenhuyzen, Queen’s University, Kingston, Ontario; P Dorian, V Korley, I Mangat, A Pinter, St Michael’s Hospital, University of Toronto, Toronto, Ontario; D Cameron, V Chauhan, K Nanthakumar, M Waxman, University Health Network, University of Toronto, Toronto, Ontario; R Hamilton, J Kim, B Stephenson, Hospital for Sick Children, University of Toronto, Toronto, Ontario; E Crystal, Sunnybrook and Women’s College Health Sciences Centre, University of Toronto, Toronto, Ontario; Y Khaykin, Z Wulffhart, South Lake Regional Health Centre, Newmarket, Ontario; A JannMohamed, Rouge Valley Centenary, Toronto, Ontario; D Newman, CAST, Toronto, Ontario; S Connolly, J Healey, C Morillo, G Nair, McMaster University, Hamilton, Ontario; G Klein, A Krass, A Skanes, R Yee, University of Western Ontario, London, Ontario; K Wolfe, Health Sciences Centre, University of Manitoba, Winnipeg, Manitoba; H Duff, D Exner, A Gillis, K Kavanagh, B Mitchell, R Sheldon, G Wyse, Libin Cardiovascular Institute of Alberta, Calgary, Alberta; M Kantock, S Kimber, A Pantano, S Sivakumar, University of Alberta, Edmonton, Alberta; C Kerr, S Sanatani, S Tang, J Yeung, University of British Columbia, Vancouver, British Columbia; R Leather, L Stens, Victoria, British Columbia.

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