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Guideline recommended treatment to targets of cardiovascular risk is inadequate in patients with inflammatory joint diseases

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ABSTRACT

Objectives: Patients with inflammatory joint diseases (IJD) have an increased risk of cardiovascular disease (CVD). Our goal was to examine indications for, and use of, lipid-lowering therapy (LLT) and antihypertensive treatment (AntiHT) in patients with IJD. Furthermore, to investigate the frequency of low-density lipoprotein cholesterol (LDL-c) and blood pressure (BP) goal attainment among IJD patients.

Methods: The cohort was derived from the NOrwegian Collaboration on Atherosclerosis in patients with Rheumatic joint diseases (NOCAR). Indications for AntiHT were: systolic/diastolic BP ≥ 140/90 mm Hg, self-reported hypertension or AntiHT. CVD risk was estimated by the systematic coronary risk evaluation (SCORE) algorithm. LDL-c goals were <2.6 mmol/L in case of diabetes, total cholesterol > 8 mmol/L or a SCORE estimate ≥ 5%, and <1.8 mmol/L for those with established CVD or SCORE ≥ 10%. Comparisons across IJD entities were performed using age and sex adjusted logistic regression.

Results: In total, 2277 patients (rheumatoid arthritis: 1376, axial spondyloarthritis: 474, psoriatic arthritis: 427) were included. LLT and AntiHT were indicated in 36.1% and 52.6% of the patients, of whom 37.6% and 47.0% were untreated, respectively. LDL-c and BP targets were obtained in 26.2% and 26.3%, respectively. Guideline recommended treatment and/or corresponding treatment targets were not initiated or obtained in approximately 50%. Rheumatoid arthritis patients were particularly likely to be undertreated with LLT, whereas hypertension undertreatment was most common in psoriatic arthritis.

Conclusions: Inadequate CVD prevention encompasses all the three major IJD entities. The unmet need for CVD preventive measures is not only prevalent in RA, but exists across all the major IJD entities.

1. Introduction

Patients with inflammatory joint diseases (IJD), including rheumatoid arthritis (RA), axial spondyloarthritis (axSpA) and psoriatic arthritis (PsA) have increased risks of cardiovascular disease (CVD) [1–6]. Current evidence is suggesting that this increased CVD burden is a consequence of high prevalences of traditional and novel CVD risk factors; the latter represented by disease activity and elevated levels of inflammation [5, 7–9]. Lipid-lowering therapy (LLT) and antihypertensive treatment (AntiHT) represent the two most common drug classes used as CVD preventive medication [10], and their effect in

Abbreviations: IJD, inflammatory joint diseases; CVD, cardiovascular disease; LLT, lipid-lowering therapy; AntiHT, antihypertensive treatment; LDL-c, low-density lipoprotein cholesterol; BP, blood pressure; NOCAR, NOrwegian Collaboration on Atherosclerosis in patients with Rheumatic joint diseases; SCORE, systematic coronary risk evaluation; RA, rheumatoid arthritis; axSpA, axial spondyloarthritis; PsA, psoriatic arthritis; EULAR, EUropean League Against Rheumatism; ESC, European Society of Cardiology; BSH, British Society for Hypertension; TC, total cholesterol; SD, standard deviation; IQR, inter-quartile range; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; KPSC, Kaiser Permanente Southern California; ATP III, Adult treatment Panel III; NSAIDs, nonsteroidal anti-inflammatory drugs.

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terms of reducing CVD events have been unprecedented [11, 12]. Evidence concerning the reduction of hard CVD end-points by LLT and AntiHT in IJD patients is limited [13]. Nevertheless, the EUropean League Against Rheumatism (EULAR) recommendations for CVD risk management in IJD patients states that the beneficial effect of LLT and AntiHT is probably similar, or even more pronounced, than in the general population [2].

Among the IJD entities, CVD risk has been most extensively studied in RA [14]. Previous studies have shown that although LLT and AntiHT are often indicated in RA patients, they are infrequently prescribed [15–24]. However, it is not currently known whether the issue of CVD preventive undertreatment is a specific feature of RA patients; or if the problem also encompasses patients with axSpA and PsA. The close relationship of most CVD outcomes with lipids and blood pressure (BP) levels underlines the importance of treating these CVD risk factors to guideline recommended targets [10]. We have previously shown that lipid goal attainment is feasible in IJD patients attending a preventive cardio-rheuma clinic [25]. However, the handful of studies that have evaluated lipid and BP goal attainment in RA patients not attending specialized CVD preventive clinics, have reported distressing rates of undertreatment [17, 19, 21, 26, 27]. Hitherto, no data exists that describe goal attainment in patients with other forms of IJD.

To be able to tailor quality improvement programs of CVD prevention for IJD patients, there is a need for a better understanding of the rates of LLT and AntiHT (under)treatment in these populations. Using data from the NOrwegian Collaboration on Atherosclerosis in patients with Rheumatic joint diseases (NOCAR) project, we wanted to compare the rates of indications for, and initiation of, CVD preventive medications across RA, axSpA and PsA. Furthermore, we aimed to evaluate if the rate of lipid and BP goal attainment differed across the major IJD entities. Our hypothesis was that suboptimal CVD prevention is not specifically related to RA, but rather an issue that is prevalent in autoimmune IJD, in general.

2. Materials and methods

The NOCAR is a collaborative project between 11 of the 15 rheumatology outpatient clinics in Norway, established to increase the focus on CVD in rheumatology practice. The project aims to ensure that all IJD patients who visit the NOCAR centers receive CVD risk assessments in line with the EULAR recommendations for CVD risk management in IJD [2]. NOCAR was approved by the local Data Protection Officers (2014/11741) and being a quality assurance project, written informed consent or approvals from regional ethics committees was not required.

The organization of the NOCAR project has previously been described in detail [28]. In short, all patients aged between 30 and 80 years with rheumatologist-verified RA, axSpA (Ankylosing spondylitis or nonradiographic axial spondyloarthritis) and/or PsA are eligible for inclusion. CVD risk assessments has been implemented into the routine practice at the rheumatology outpatient clinics and includes three steps: 1) Non-fasting lipids are added to routine rheumatology laboratory tests, 2) Patients self-report CVD risk factors/comorbidities and CVD preventive medications, 3) Nurses perform BP measurements at the time of the clinical joint examination. In case of elevated BP levels, three measurements are performed and the mean of the two last measurements was recorded. Absolute 10 year risk of a fatal CVD event was automatically calculated using the Systematic COronary Risk Evaluation (SCORE) algorithm, which was implemented into the electronic patient journal [29].

In accordance with the European Society of Cardiology (ESC) guidelines, the CVD risk (calculated by SCORE) was not estimated in patients with established CVD, diabetes, total cholesterol (TC) > 8.0 mmol/L or currently using LLT [10]. However, in agreement with the British Society for Hypertension (BSH) and Heart UK recommendations [30, 31], we estimated the CVD risk for patients who were current users of AntiHT, acknowledging that this will entail underestimations of the actual CVD risk estimates. Conforming to the EULAR recommendations for CVD risk assessment in IJD patients, a 1.5 multiplier was also applied to the SCORE estimates of CVD risk for all RA patients [2]. In accordance with ESC guidelines for CVD prevention, patients with established CVD (i.e. self-reported myocardial infarction, stroke, surgical coronary interventions or peripheral artery disease) or an estimated CVD risk ≥ 10%, were defined as having "very high CVD risk", whereas patients self-reported diabetes mellitus, total cholesterol ≥ 8.1 mmol/L or an estimated CVD risk ≥ 5% were defined as having "high CVD risk" [10]. Comorbidity data was not sufficiently detailed to identify patients for whom LLT was indicated on the basis of concomitant stage > 2 chronic kidney disease. In cases where a patient was treated with LLT and the indication was unknown, a conservative approach was applied, defining the patient as "high CVD risk", rather than "very high CVD risk". Finally, we applied the lipid targets defined by ESC, i.e. low-density lipoprotein cholesterol (LDL-c) < 2.6 mmol/L for patients with "high CVD risk" and <1.8 mmol/L for those with "very high CVD risk" [10].

The presence of an indication for AntiHT, and attainment of BP goals were also determined in accordance with ESC guidelines [10]. Need for AntiHT was thus defined as self-reported hypertension, BP levels > 140/90 mm Hg (>140/85 mm Hg for diabetics) and current AntiHT use. BP goals were <140/90 mm Hg and <140/85 for patients with diabetes (types 1 and 2).

Only patients with complete information on BP levels and lipoprotein levels, as well as data regarding indications for, and current use of LLT and AntiHT were included in the analyses in this project.

3. Calculation

In the current analyses, demographic data, as well as supplementary comparisons of patients with and without complete information regarding indications for and current use of AntiHT and LLT, are presented as mean with standard deviation (SD) and median with inter-quartile ranges (IQR) for normally and non-normally distributed variables, respectively. Dichotomous variables are presented as number with percentages. Non-normally distributed variables were log-transformed prior to comparisons, *t*-tests and chi-squared tests were applied as appropriate.

Firstly, for LLT (1a) and AntiHT (1b) separately, we calculated the crude proportions of patients who: Had indications for the drug therapy, as well as the proportions of patients who had an indication for the drug and were receiving the treatment, and finally the proportion of patients who were treated and had reached lipid/BP goals. The proportions (1a and 1b) were calculated for the cohort as a whole, as well as for the separate IJD entities, individually.

Secondly, we constructed age and sex adjusted logistic regression models to compare the following rates across the three IJD entities: Rates of patients who 2a) were on LLT; 2b) were on LLT and had obtained lipid goals; 2c) were on AntiHT; 2d) were on AntiHT and had attained BP goals; 3a) were not on LLT, despite having an indication for such treatment; 3b) had indication for LLT, but were not, or inadequately, treated; 3c) had indication for AntiHT, but who were not treated; 3d) had indication for AntiHT, but were not, or inadequately, treated; 3e) had indication for LLT and/or AntiHT, but were not treated; and 3f) had indication for LLT and/or AntiHT, but were not, or inadequately, treated.

Statistical analyses were preformed using the SPSS Statistics for Windows Version 21.0 (IBM Corp, Armonk, NY. Released 2012) and STATA Release 14.0 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP).

4. Results

4.1. Demographics

In total, 2277 patients were included in the analyses (RA $n = 1376$, axSpA $n = 474$, PsA $n = 427$). The median age (IQR) of the whole cohort was 56.2 (46.3–65.2) years, ranging from 47.2 in axSpA to 60.8 years in RA patients (Table 1). In general, 57.3% were female and, as expected, there were considerable differences across the IJD entities (RA: 68.6%, axSpA: 31.2%, PsA: 49.9%). The median (IQR) disease duration was 8.3 (3.9–16.0) years, which was lower in PsA (7.3 years) and higher in axSpA patients (10.7 years).

The patients who were excluded from analyses because of incomplete data regarding CVD prevention-related variables had significantly worse CVD risk factor profiles (higher body mass index, BP, TC and LDL-c) and rheumatology disease-related variables (higher erythrocyte sedimentation rate [ESR], C-reactive protein [CRP] and patient's global assessment, as well as longer disease durations) compared to the patients with complete data who were kept in the analyses (Supplementary Table 1).

Table 1
Patient characteristics.

	All IJD	RA	axSpA	PsA
	N = 2277	N = 1376	N = 474	N = 427
Demographic variables				
Age (years), median (IQR)	56.2 (46.3–65.2)	60.8 (51.1–68.5)	47.2 (40.8–56.2)	51.4 (43.5–59.5)
Sex (female), n (%)	1305 (57.3)	944 (68.6)	148 (31.2)	213 (49.9)
Working (current), n (%)	1147 (50.4)	573 (42.3)	326 (69.8)	248 (59.3)
Sick leave/disabled (current), n (%)	613 (26.9)	369 (27.2)	117 (25.1)	127 (30.4)
Pensioner (current), n (%)	481 (21.1)	414 (30.5)	24 (5.1)	43 (10.3)
Education (years)	12.8 ± 3.3	12.3 ± 3.4	13.8 ± 3.2	13.3 ± 3.2
Cardiovascular disease related variables				
BMI (kg/m^2), mean ± SD	26.3 ± 4.6	26.0 ± 4.5	26.1 ± 4.2	27.9 ± 4.9
Smoking (current), n (%)	471 (20.7)	304 (22.1)	95 (20.0)	73 (17.1)
Smoking (ever), n (%)	1368 (60.1)	857 (62.8)	275 (58.4)	236 (55.3)
SysBP (mm Hg), mean ± SD	131.5 ± 16.7	131.8 ± 17.0	128.5 ± 15.2	134.0 ± 16.9
DiaBP (mm Hg), mean ± SD	79.9 ± 9.4	79.2 ± 9.1	80.1 ± 9.7	82.0 ± 9.4
TC (mmol/L), mean ± SD	5.27 ± 1.10	5.27 ± 1.11	5.20 ± 1.12	5.34 ± 1.12
LDL-c (mmol/L), mean ± SD	3.18 ± 1.00	3.16 ± 0.99	3.17 ± 1.01	3.27 ± 1.04
HDL-c (mmol/L), mean ± SD	1.56 ± 0.51	1.62 ± 0.53	1.47 ± 0.50	1.47 ± 0.46
Trigs (mmol/L), median (IQR)	1.30 (0.95–1.82)	1.26 (0.94–1.74)	1.35 (0.93–1.91)	1.40 (1.00–2.10)
Rheumatology disease related variables				
Disease duration	8.3 (3.9–16.0)	8.2 (4.0–14.7)	10.7 (4.6–20.9)	7.3 (3.0–14.8)
ACPA (positive), n (%)		725 (79.8)		
RF (positive), n (%)		557 (66.9)		
CRP (mg/L), median (IQR)	2.00 (1.00–5.00)	2.00 (1.00–5.00)	2.00 (1.00–5.00)	3.00 (1.00–5.00)
ESR (mm/h), mean ± SD	12.4 ± 12.2	13.4 ± 12.4	10.3 ± 10.7	11.5 ± 12.5
DAS28 (ESR), mean ± SD		2.52 ± 1.20		
CDAI, mean ± SD		6.77 ± 7.00		
BASDAI, mean ± SD			2.01 ± 2.26	0.55 ± 0.32
ASDAS (CRP), mean ± SD			1.74 ± 0.92	1.47 ± 0.44
Anti-rheumatic medication				
sDMARDs (current use), n (%)	1314 (57.7)	1043 (75.8)	46 (9.7)	225 (52.7)
Prednisone (current use), n (%)	437 (19.2)	399 (29.0)	7 (1.5)	31 (7.3)
bDMARDs (current use), n (%)	1123 (49.3)	584 (42.4)	300 (63.3)	239 (56.0)
Number of bDMARDs tried, median (IQR)	1.00 (0.00–2.00)	1.00 (0.00–2.00)	1.00 (0.75–2.00)	1.00 (0.00–2.00)

RA: Rheumatoid arthritis, axSpA: Axial spondyloarthritis, PsA: Psoriatic arthritis, IQR: Inter-quartile range, n: number, BMI: Body mass index, SD: Standard deviation, SysBP: Systolic blood pressure, DiaBP: Diastolic blood pressure, TC: Total cholesterol, LDL-c: Low-density lipoprotein cholesterol, HDL-c: High-density lipoprotein cholesterol, Trigs: Triglycerides, ACPA: Anti-citrullinated protein antibodies, RF: Rheumatoid factor, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, DAS28: Disease activity score using 28 joint counts, CDAI: Clinical disease activity index, BASDAI: Bath ankylosing spondylitis disease activity index, ASDAS: Ankylosing spondylitis disease activity score, sDMARD: synthetic disease-modifying antirheumatic drugs.

4.2. Frequency of indications for CVD preventive medications and treatment to targets

Overall, more than one in three patients had an indication for LLT, from 21.9% in axSpA to 44.3% in RA patients (Fig. 1a). Among the patients who had an indication for LLT, 37.6% were not receiving such treatment and only one in four patients had obtained LDL-c goals with substantial variations across the IJD entities.

While 52.6% of the patients as a whole had indications for AntiHT, under half of these patients were receiving such treatment (Fig. 1b). Furthermore, only every second patient who were on AntiHT had reached guideline-recommended treatment targets. The rates of BP undertreatment were highest in PsA patients.

4.3. Treatment to targets with CVD preventive drugs across IJD

Logistic regression analyses adjusted for age and sex revealed that roughly one in four patients were receiving LLT in all the three IJD groups (Fig. 2a). However, PsA patients were significantly more likely to reach lipid targets compared to those with RA ($p = 0.03$) (Fig. 2b). AntiHT was significantly more frequent among patients with axSpA compared to RA ($p = 0.02$) (Fig. 2c). The rates of BP goal attainment among patients receiving AntiHT were largely comparable across the IJD entities (Fig. 2d).

4.4. Undertreatment with CVD preventive medications across IJD

The proportion of patients without LLT despite indication was significantly higher in RA patients compared those with PsA ($p = 0.03$) (Fig. 3a). The same pattern was found when comparing the proportions of patients with indications for LLT who were either not treated, or inadequately treated ($p = 0.01$) (Fig. 3b).

Conversely, the proportion of patients who were not receiving AntiHT, despite indication, was significantly higher in PsA patients than in RA or axSpA ($p \leq 0.001$ for both) (Fig. 3c). Nearly half of the PsA patients who had indications for AntiHT were either untreated or inadequately treated and this was significantly different from both RA and axSpA patients ($p < 0.001$ for both) (Fig. 3d).

Furthermore, 39.5% of the PsA patients who had an indication for either AntiHT and/or LLT were untreated, which was significantly higher than in patients with RA ($p = 0.02$) and axSpA ($p < 0.001$) (Fig. 3e). Suboptimal CVD preventive treatment (i.e. no or inadequate treatment when there was an indication for LLT and/or AntiHT) was higher in PsA patients (56.2%) compared to patients with RA ($p = 0.04$) and axSpA ($p = 0.001$) (Fig. 3f).

5. Discussion

Using data from a Norwegian nationwide quality assurance project, we have exposed substantial shortcomings in the use of common CVD preventive drugs among IJD patients, despite there being frequent indications for such medications. Moreover, even when these drugs are initiated, few IJD patients reach guideline-recommended LDL-c and BP targets. Accordingly, the results confirm our hypothesis that suboptimal CVD prevention is not an issue specifically related to RA, but rather a problem that is prevalent in all the three major IJD entities. Furthermore, we did uncover some considerable differences across the

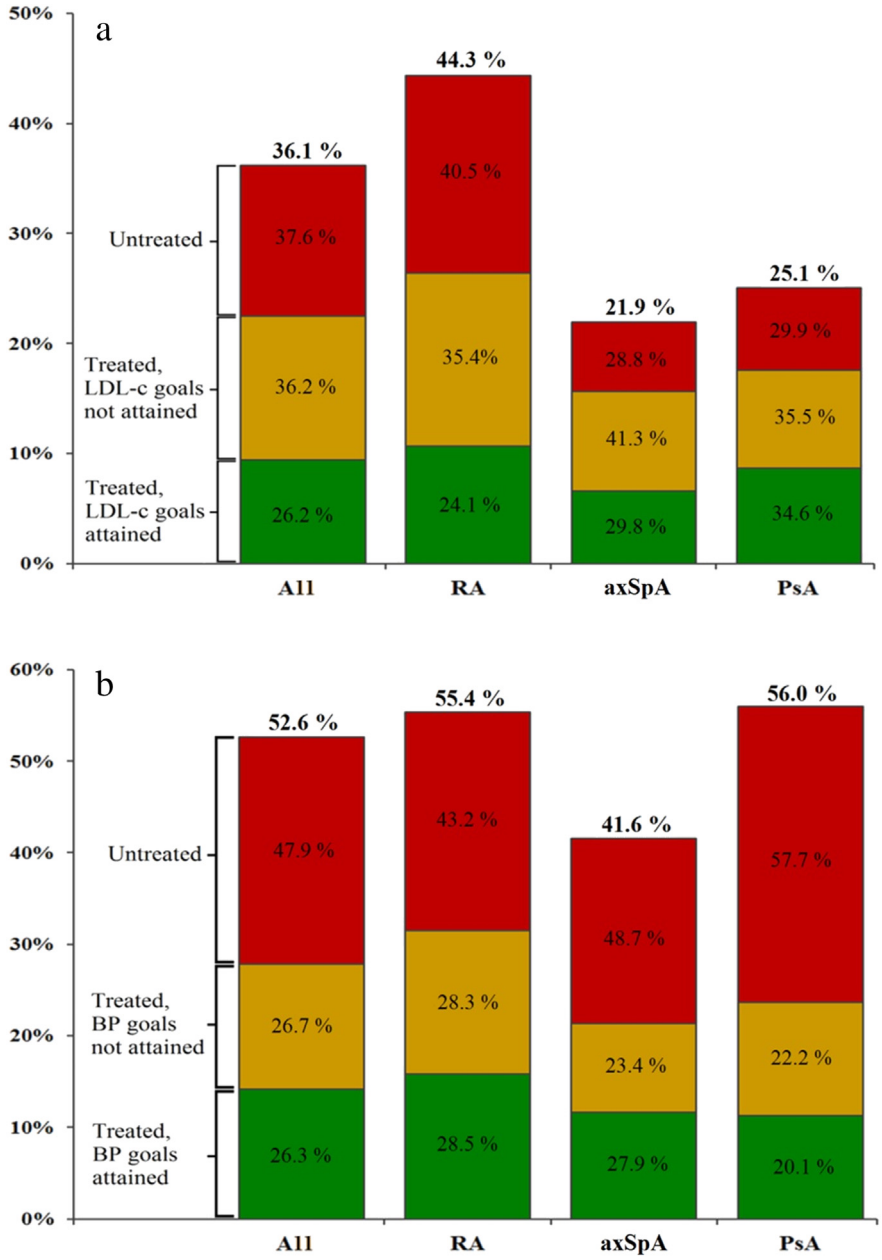

Fig. 1. a–b. Frequencies of indications for cardiovascular disease preventive drugs, proportions of patients treated with cardiovascular disease preventive drugs and rates of treatment goal attainment, across inflammatory joint disease entities. LLT: lipid lowering treatment, AntiHT: antihypertensive treatment, RA: rheumatoid arthritis, axSpA: ankylosing spondylitis, PsA: psoriatic arthritis, LDL-c: low-density lipoprotein cholesterol, BP: blood pressure. Crude data.

IJD subgroups in that RA patients were more likely to be undertreated with regards to their lipid profiles, while suboptimal management of hypertension was more common in PsA.

Several studies have previously demonstrated substantial underuse of LLT and AntiHT in RA patients [15–24, 32]. Due to diverging thresholds for treatment indications, small patient populations and use of database-derived cohorts, it is difficult to compare the estimates from these previous reports to the estimates that were yielded in the NOCAR project. Nevertheless, the general conclusion that there is a large potential for improvement of CVD prevention in RA is in line with preceding knowledge [15–24]. There is a knowledge gap concerning the quality of CVD prevention in PsA and axSpA patients, and to the best of our knowledge, this is the first report of a substantial deviation from guideline-recommended CVD preventive treatment in these patients.

We have previously shown that hypertension and elevated total cholesterol levels are frequent in all IJD patients [33], and that there are no large differences in the lipid-lowering properties of statins across the three major IJD entities [25]. It is therefore surprising that the RA patients in the NOCAR project were more likely to have persistently elevated LDL-c levels despite taking LLT, compared to axSpA (non-significant) and PsA patients (significant). These differences may appear to be consequences of the EULAR-recommended 1.5 multiplier applied to the SCORE estimates for RA patients [2]. However, additional analyses showed that the multiplier affected the indication for LLT for under 5% of the RA patiens, and can thus not wholly explain the discrepancies (data not shown).

There was also a substantial underuse of AntiHT in all the IJD entities. In fact, half of the PsA patients who had an indication for AntiHT were either untreated or not treated to guideline recommended treatment

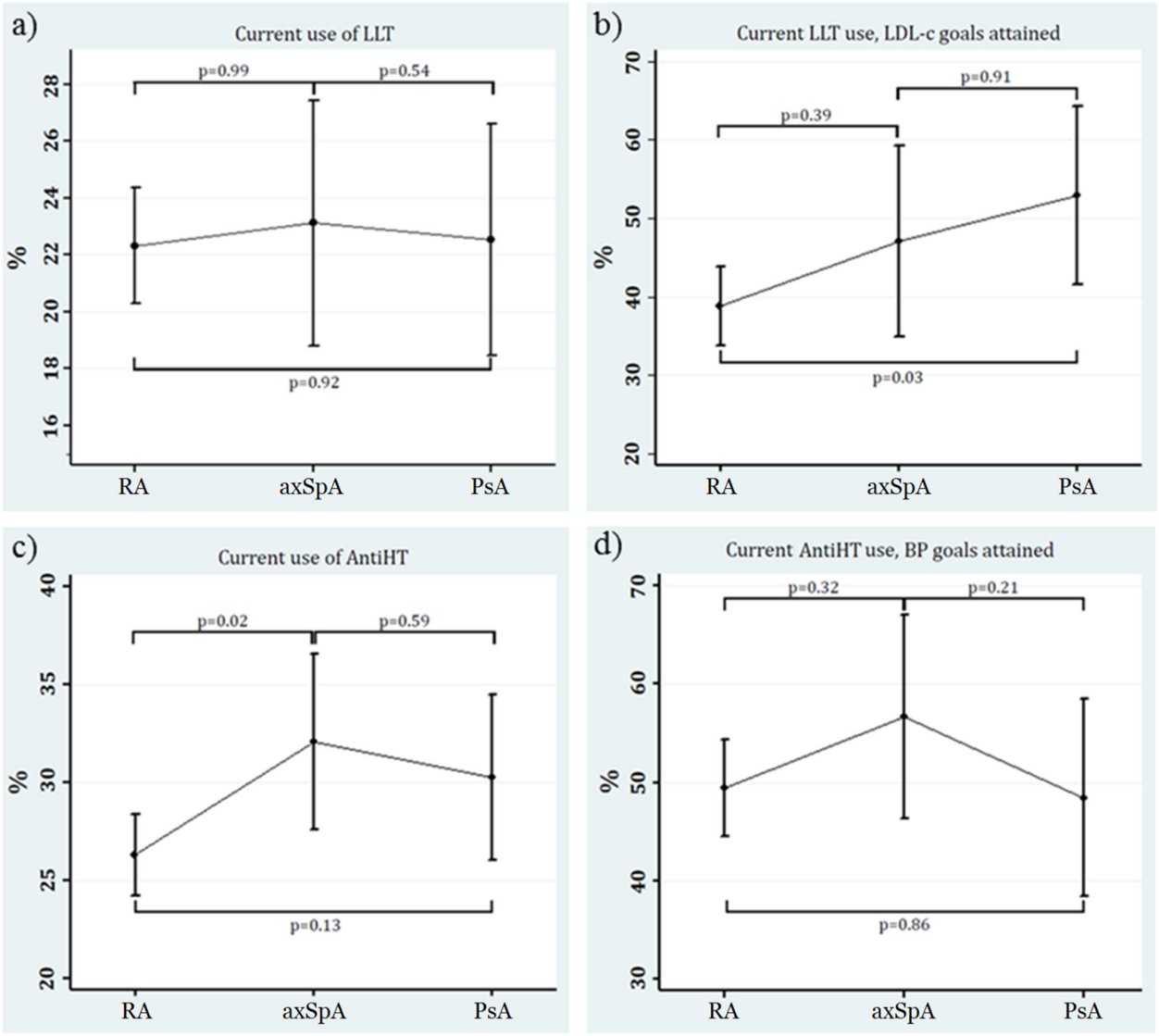

Fig. 2. a–d. Comparisons of use of cardiovascular disease preventive drugs and treatment goal attainment, across inflammatory joint disease entities. Abbreviations as in Fig. 1. Age and sex adjusted analyses.

targets. Previous meta-analyses have shown that while BP levels in RA and axSpA patients are probably quite similar to non-IJD individuals [34, 35], the prevalence of hypertension is substantially higher among PsA patients [36, 37]. Obesity is a known driver for hypertension [38], and indeed, the BMI of the PsA patients in NOCAR was markedly higher than among RA and axSpA patients. Moreover, high BMI in is associated with poor BP control in RA patients, although this association has not been shown for PsA patients [19].

Almost 40% of the patients with PsA, and approximately one in three of those with RA and axSpA were not treated with AntiHT and/or LLT when such therapies were indicated. When adding the latter estimates to those who were inadequately treated with LLT and/or AntiHT, we found that approximately 50% in all the three IJD entities were receiving suboptimal CVD prevention. In other words, every second patient in this project was in need for initiation and/or adjustments of CVD preventive therapies.

There are a few studies that have reported on the rates of lipid and BP goal attainment in RA patients [17, 19, 21, 26, 27]. Again, these reports are not readily comparable to our results due to different LDL-c and BP treatment targets, small cohorts or data extracted from larger administrative databases. In a report based on administrative databases and electronic medical journals from Kaiser Permanente Southern California (KPSC), 62% of RA patients had obtained LDL-c goals [23], which is considerably higher than the rate of 42% in our project. An explanation may be the particular focus on clinical target achievement in the KPSC system [23]. Along the same lines, Chung et al. showed that 57% of the 88 RA patients in their study had attained LDL-c goals [24]. Notably, the latter two studies followed the more modest 2002 Adult Treatment Panel III (ATP III) recommendations for LDL-c targets, making lipid targets more readily achievable compared to the ESC treatment targets that we have based our analyses on [10, 39].

Half of the patients who were on AntiHT in our project obtained BP target, which is remarkably similar to results yielded in other studies that have previously evaluated BP goal attainment in RA [19, 20, 24, 26]. A notable exception being the aforementioned study by An et al., in which high rates of BP goal achievement was found, again probably attributable to the high focus on clinical targets in KPSC [23].

There are many potential explanations for the aforementioned shortcomings in CVD risk factor management revealed in our IJD patient cohort. There is a lack of "ownership" for the CVD aspect of IJD patients, i.e. it is not clear whether it is the responsibility of the cardiologist, the general physician (GP) or the rheumatologist [2, 40, 41]. While the rheumatologist may be hesitant about managing CVD risk factors because it is not part of the traditional scope of rheumatology, the GP

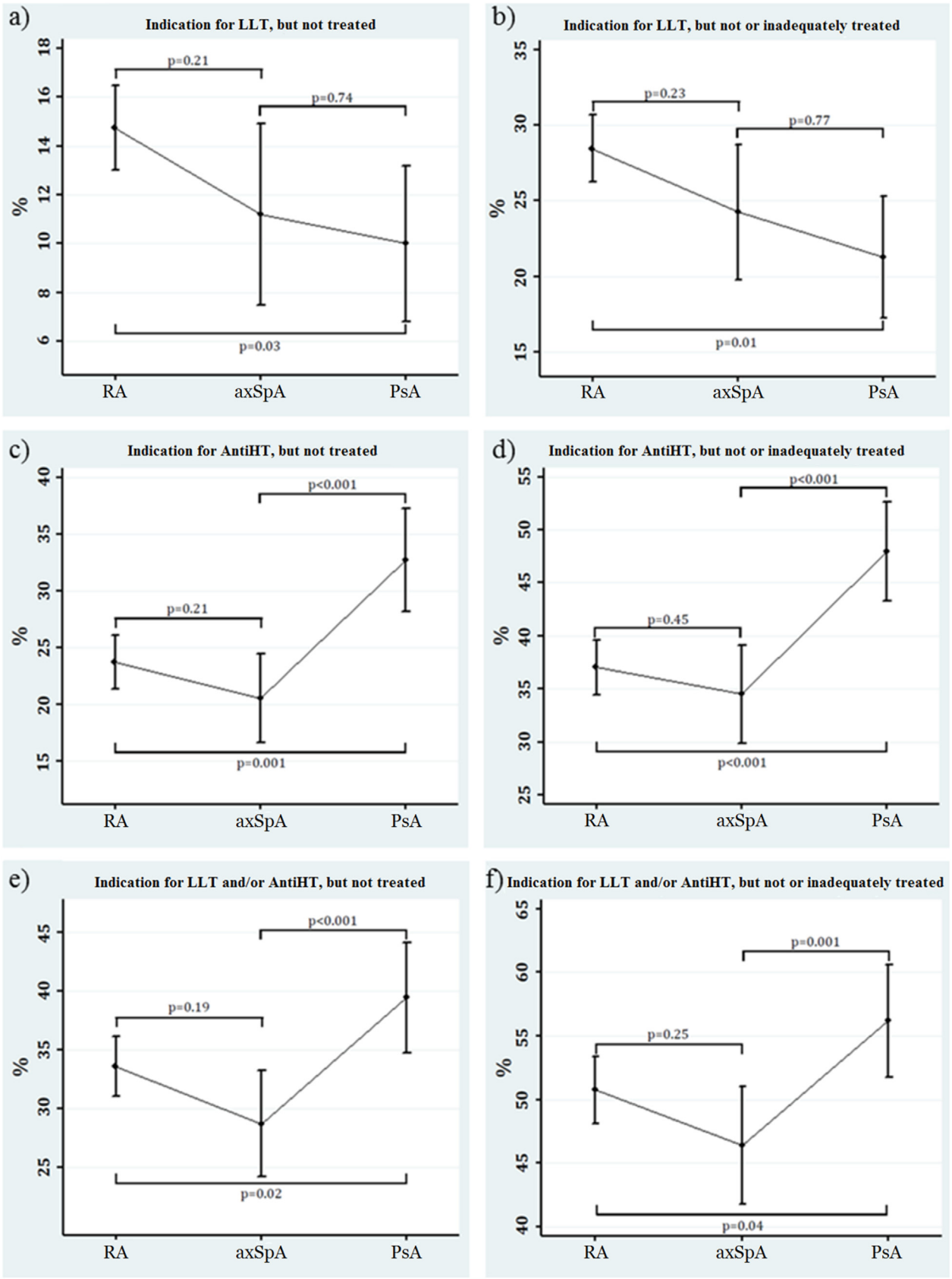

Fig. 3. a–d. Comparisons of undertreatment with cardiovascular disease preventive drugs across inflammatory joint disease entities. Abbreviations as in Fig. 1. Age and sex adjusted analyses.

may not be aware of the increased CVD risk in this patient group [42]. Secondly, there may be a reluctancy among physicians to initiate new medicines or to intensify treatment regimens in IJD patients who are already treated with numerous antirheumatic drugs. There are however, no present-day indications that the undertreatment is tied directly to inflammation or rheumatic disease activity. In fact, LLT and antiHT

appear to be at least as effective in IJD patients as in non-IJD individuals, and existing data does not suggest that their effects are adversely impacted by inflammation or disease activity [2, 43–45]. The latter notion is backed by additional logistic regression analyses in which we did not find associations between systemic inflammatory levels (ESR, CRP), disease activity (DAS28, CDAI, BASDAI, ASDAS), or previous/current use of antirheumatic medications (prednisolone, synthetic or biologic disease-modifying antirheumatic drugs) and CVD risk factor goal attainment (data not shown). We would however, like to underline the importance of lowering inflammation levels in this patient population, as it is probably paramount to reducing their CVD risk burden [2].

There are several limitations to this project. First, we did not have a general population comparator group. Two previous studies have concluded that although LDL-c and BP goal attainment in RA patients is far from optimal, it may not be worse than in the general population [23, 24]. Considering the increased CVD risk in IJD patients, one may argue that they should be compared with other high CVD risk patient groups, rather than the general population. For instance, Desai et al. report from a general practice study that while RA patients received only slightly less CVD preventive drugs than controls compared to the general population, they received half as much LLT and AntiHT as patients with diabetes [15]. Another interesting study reporting from the general population showed among 22,000 statin-treated individuals, rates of lipid targets achievement were best among patients with higher CVD risk [46]. Second, since the aim of the current project was to evaluate the use of CVD preventive therapies among patients with IJD, we selected only the patients for whom complete information regarding these drugs and their respective indications was available. It should be noted that the patients who were excluded due to incomplete data had significantly worse CVD risk profiles than the patients who were kept in the analyses. Thus, we deem it unlikely that the exclusion of patients from our analyses have led to overestimation of undertreatment rates. Third, there lies an important limitation in the lack of data on compliance to CVD preventive medications, which is known to decline as time passes [47]. Lastly, nonsteroidal anti-inflammatory drugs (NSAIDs) use, which is known to adversely influence BP, had to be excluded from analyses due to infrequent reporting, and our conclusions have to be interpreted with this caveat in mind.

6. Conclusions

In conclusion, we have shown that while CVD preventive medications are often indicated in patients with IJD, they are infrequently initiated. Moreover, when LLT and AntiHT are instituted, 50% of patients still did not achieve guideline-recommended treatment targets. There is a huge unmet need for improvement of CVD risk assessment, initiation of proper CVD preventive measures and careful monitoring of target achievements in IJD patients.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijcard.2018.06.111.

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