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# Prognosis of Good syndrome: mortality and morbidity of thymoma associated immunodeficiency in perspective

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ABSTRACT

Good syndrome (GS) or thymoma-associated immunodeficiency, is a rare condition that has only been studied in retrospective case series. General consensus was that GS has a worse prognosis than other humoral immunodeficiencies. In this study, physicians of GS patients completed two questionnaires with a two year interval with data on 47 patients, 499 patient years in total. Results on epidemiology, disease characteristics, and outcome are presented. Mean age at diagnosis was 60 years and median follow-up from onset of symptoms was 9 years. There was a high frequency of respiratory tract infections due to encapsulated bacteria. Median survival was 14 years. Survival was reduced compared to age-matched population controls (5-year survival: 82% versus 95%, p = 0.008). In this cohort survival was not associated with gender (HR 0.9, 95% CI 0.3–3.0), autoimmune diseases (HR 2.9, 95% CI 0.8–10.1) or immunosuppressive use (HR 0.3, 95% CI: 0.1–1.2).



## 1. Introduction

In 1954 Robert Good described three patients with thymoma and hypogammaglobulinemia [1]. Today, the condition is designated as Good syndrome (GS) [1]. It is typically an adult-onset immunodeficiency rendering patients susceptible to bacterial, viral, fungal and opportunistic infections. Immunological features of GS include hypogammaglobulinemia, a reduction in peripheral B-cells, CD4+ lymphopenia and reversal of CD4/CD8 ratio. In one series comprising 18 thymoma patients, whose immunophenotype was assessed, 12 patients were found to have immunological abnormalities such as B-cell and T-cell lymphopenia, whereas hypogammaglobulinemia was found in only 4 patients [2]. So far, GS has only been studied retrospectively in case reports and small retrospective case series. Therefore, the course of disease is not well understood. Reviews suggest that GS has a worse prognosis than other immunodeficiencies [3] with a mortality of 44.5% [4] to 57% [5], although follow-up time is unclear. In the present study, performed in 2012 and 2014, we collected new data, to assess the course and prognosis of GS by means of a prospective cohort study.

## 2. Methods

### 2.1. Subjects

Due to lack of diagnostic criteria and differing definitions in the literature, the following inclusion criteria were employed: 'Classical Good syndrome': patients with a combination of a thymoma and hypogammaglobulinemia. 'Probable Good syndrome': patients who either have thymoma or thymic carcinoma and any unclassified immunodeficiency, but do not meet the criteria for classical Good syndrome. Patient data were collected in two ways. A PubMed search was

*Abbreviations:* BAFF-R, B-cell activating factor receptor; CMV, Cytomegalovirus; CVID, common variable immunodeficiency; ESID, European Society for Immunodefiencies; GS, Good syndrome; G-CSF, Granulocyt e-Colony Stimulating Factor; TACI, Transmembrane activator and CAML interactor.

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conducted applying the terms 'thymoma' and 'immunodeficiency'. Articles dating back to 1984 written in English, German and French were assessed for suitability. This yielded 53 articles describing 67 patients. All 53 corresponding authors were sent an anonymised questionnaire regarding their patients, and were also asked to include any other patients that they had under their care. In addition, the European Society for Immunodeficiencies (ESID) facilitated us to contact all 13 centers that had registered patients with GS in the ESID online database. We asked them to complete the same anonymised questionnaire for the 54 patients that were registered. The questionnaires were sent out in 2012 (n = 53 + 13). In 2014 we sent a second questionnaire to the authors (n = 12) and centers (n = 5) that responded to the first questionnaire and reported data of non-deceased patients.

This study did not fall under the Medical Research Involving Human Subjects Act (WMO) because it concerned anonymised data from patient records, and therefore did not need to undergo a medical ethical review.

**Table 1**
Country of origin.

| Country | Total number of included GS patients |
|---|---|
| *Europe* | |
| United Kingdom | 13 |
| Spain | 7 |
| Czech Republic | 5 |
| The Netherlands | 4 |
| Finland | 4 |
| France | 1 |
| Germany | 1 |
| Poland | 1 |
| *Asia* | |
| Japan | 7 |
| China | 3 |
| *USA* | 1 |

### 2.2. Instruments

In the first questionnaire, data was collected on age, gender, age at diagnosis characteristics of the thymoma associated infections and autoimmune disease alongside immunological parameters, therapy and course of the disease so far. Two years later, a follow-up questionnaire, focusing on the course of the disease since the first questionnaire, was compiled consisting of questions about thymoma recurrence, hospital admissions, infections and the development of malignancy.

### 2.3. Statistical analysis

Statistics were performed using Graphpad Prism v5.03. A p-value of $<0.05$ was considered statistically significant. Descriptive statistics were generated (mean, standard deviation, median and range) where applicable and the frequency distribution was calculated for categorical data. The Wilcoxon signed rank test was used to calculate differences when medians were provided, whereas categorical data was analysed with the Fisher's exact test. Correlation was assessed using Spearman's rank correlation coefficient and survival analysis was performed with the Kaplan Meier analysis. Probabilities of survival after diagnosis of GS were compared to the expected survival of the general population of similar mean age, based on the European life tables from 2005 [6]. Differences in survival were assessed with the Log-Rank test. A multivariate Cox regression analysis was performed, using the fixed covariates gender, immunosuppressives use (including periodically used steroids) and presence of autoimmune diseases at any time during the course of the disease. The hazard ratios (HR) and the 95% confidence intervals were calculated.

## 3. Results

The 2012 questionnaire was completed and returned by 12 authors (response rate 23%) and 5 centers (38%) and comprised 18 and 29 (total 47) patients respectively. Patients originated from different countries as is shown in Table 1. Of these 47 patients, 35 were alive and 12 were deceased. The 2014 questionnaire was returned by 7 authors (response rate 58%) and 5 centers (100%) and comprised follow-up data of 27 patients, 23 of them were still alive and 4 had succumbed in the last 2 years. See Fig. 1.

### 3.1. Baseline characteristics

Median age at diagnosis was 58 years (range 38 to 85 years) with the exclusion of one paediatric case (detailed below). No significant difference was found between men and women in terms of age at diagnosis. There were 23 men and 24 women at baseline; in the second questionnaire, men represented 44% (of 27 patients). The median age at diagnosis of the thymoma was 58 years (range 30–80 years) and the median age relating to the start of infections was 57 years (range 31–82). In 5 patients (11%) the thymoma was the first sign of GS, in 20 patients (42%) the symptoms started almost simultaneously (within a year) and infections preceded the diagnosis of the thymoma in 19 patients (40%). The mean delay in diagnosis was 3.1 years (range 0 to 17 years), with a median of 1 year. There was no correlation between the first sign (thymoma or infections) and the duration of delay. We had a total follow-up of 498.8 patient years, with a median of 9 years per patient (range 0.25–27 years), from onset of symptoms to the final data collected.

The paediatric case involved an eleven-year-old patient with a thymoma and hypogammaglobulinemia. Infections started at 6 years of age. This patient is of unusually young age for GS and does meet the classic criteria for this condition. Only one paediatric case of GS has been described in the literature [7].

### 3.2. Thymoma

Thymoma was an incidental finding on a CT or X-ray in 41% of patients; in 59% (of 44 patients) symptoms prompted diagnostic investigations (CT-scan or X-ray). These symptoms included: chronic or persistent cough (n = 10), shortness of breath (n = 3), weight loss (n = 3), respiratory tract infections (n = 7), and other symptoms such as superior vena cava obstruction (n = 1) or sternal pain (n = 1). In three cases an associated autoimmune syndrome or paraneoplastic syndrome was the reason for the diagnostic workup for thymoma. The most commonly found type according to the WHO system of thymoma was A (37.8%), other types such as B (all subtypes), AB and C were found in 24.3%, 35.1%, and 2.7% of patients respectively, from a total of 37 patients.

### 3.3. Immunodeficiency and infections

All patients presented with marked hypogammaglobulinemia (Table 2), often accompanied by decreased or absent numbers of circulating B-cells. Only two patients (of 38 patients) presented with a B-cell count of more than $200 \times 10^6$/l. Reduced numbers of CD4+ T-cells were reported in 62% of patients, usually mild, while 20% had a frank CD4+ T-cell lymphopenia.

Only one patient with classical GS had not experienced infections at the time of the first questionnaire (5 years of follow-up). Thirty-five patients (74%) had at least one lower respiratory tract infection, which was the most frequently reported infection followed by upper respiratory tract infections (n = 25). Seventeen patients had gastrointestinal tract infections (36%), 10 patients had infections of skin and soft tissue (21%), 7 patients had urinary tract infections (15%), 5 systemic infections (11%) and 15 (32%) had other infections which consisted mostly

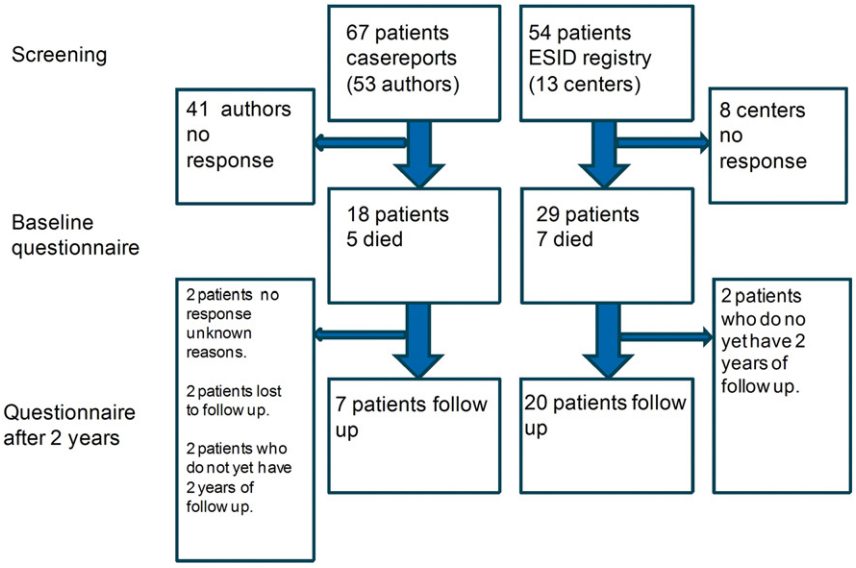


**Fig. 1.** Loss to follow up. Abbreviations: ESID: European Society for immunodeficiencies. 12 casereports references: [23–34].

of (encephalo)-meningitis and conjunctivitis. This same pattern of infections was reported in the follow-up questionnaire two years later.

As regards the causative micro-organism, bacterial infections were most common (80% of patients) but 23% of patients had encountered viral infections and 26% fungal infections (Fig. 2). Table 3 provides a list of known pathogens reported in both questionnaires. CMV, Aspergillus and Candida infections, occurring in 15 patients of which 6 were treated with corticosteroids or other immunosuppressives, were not associated with a lower CD4 + T-cells number ($p = 0.91$). Whether Candida infections, which were mostly oral or vaginal, occurred after antibiotic use was not recorded.

### 3.4. Autoimmune disorders

Twenty-four patients (51%) had an autoimmune disease and 8 patients had >1 autoimmune disease. Pure red cell aplasia (8 patients) was the most frequent autoimmune disease, followed by lichen planus (7 patients). Other autoimmune diseases that were reported multiple times were myasthenia gravis and aplastic anemia. Thirteen other autoimmune diseases were reported only once (Table 4). In the second questionnaire, 2 patients out of 27 had developed a new autoimmune disease in the 2 years follow-up since the baseline questionnaire: one case of hypothyroidism and one case of subacute cutaneous lupus. There was no significant difference in the types of thymoma between the patients with and without autoimmune manifestations.

### 3.5. Management and prognosis

Forty-four patients (93.6%) received immunoglobulin supplementation and 29 patients (63.0%) received some form of antibiotic prophylaxis. Most patients did not have other treatment, although 27.7% were treated with immunosuppressive agents and 8.5% received G-CSF.

The baseline questionnaire also assessed the clinical course of disease from diagnosis along with the patients current status (with a median of 8 years after onset of symptoms). In most patients, the immunodeficiency they presented with remained stable over the follow-up period. Fifty-five percent of patients were reported to still have frequent infectious diseases, while 9% of patients were asymptomatic. Of all patients with data on the course of the autoimmune disease (17 patients), 18% of patients had improvement of the autoimmune disease, in 47% there was no change and in 35% the disease had deteriorated.

Five patients developed a malignancy. The reported malignancies were skin cancer (2), large granular T-cell lymphoma, thyroid cancer and one unknown malignancy. A single patient had a recurrence of the thymoma, initial WHO type A, approximately 5 years after the initial diagnosis.

During the 2 years of follow up until the second questionnaire, 8 patients (32%) were admitted to hospital at least once and 19 patients (76%) reported infections. One patient had 4 hospital admissions due to seizures, thrombocytopenia and secondary hemochromatosis after frequent transfusions. Three patients had a hospital admission due to probable infections (sepsis, lower respiratory tract infection, suspected

**Table 2**
Laboratory values.

| Laboratory values | N | Median | Range | Median general population | p-Value median |
|---|---|---|---|---|---|
| IgG | 45 | 228.0 mg/dl | 7.0–666.0 | 1090 mg/dl | <0.001* |
| IgA | 47 | 25.0 mg/dl | 1.0–180.0 | 239 mg/dl | <0.001* |
| IgM | 47 | 10.0 mg/dl | 0–49.0 | 134 mg/dl | <0.001* |
| B-cells | 38 | $0.0 \times 10^6$/l | 0.0–406.0 | $200 \times 10^6$/l | <0.001* |
| CD4 + T-cells | 36 | $565.0 \times 10^9$/l | 65.0–2390 | $700 \times 10^6$/l | 0.02* |
| Hemoglobin | 33 | 12.9 g/dl | 8.1–16.1 | 14.1 g/dl | <0.001* |
| Hemoglobin male | 16 | 13.0 g/dl | 8.1–16.1 | 14.9 g/dl | 0.002* |
| Hemoglobin female | 17 | 12.6 g/dl | 14.2–10.7 | 13.4 g/dl | 0.01* |
| Thrombocytes | 37 | $279.0 \times 10^9$/l | 33.0–617.0 | $260 \times 10^9$/l | 0.53 |
| Neutrophils | 42 | $385.0 \times 10^7$/l | 0.0–2673 | – | – |
| Natural Killer cells | 28 | $155.0 \times 10^6$/l | 102.0–301.0 | $300 \times 10^6$/l | 0.06 |

Table 2 Reference values: Gonzalez-Quintela 2007 [20] for immunoglobulins, Comans 1997 for B-cells [21], T-cells and NK-cells, Hollowell 2005 for other laboratory values [22]. Medians are derived from average medians for patients of 40 years and older. Patients from our cohort with autoimmune anemia are excluded as well as patients with autoimmune thrombocytopenia, * = $p < 0.05$; significantly different from normal median.

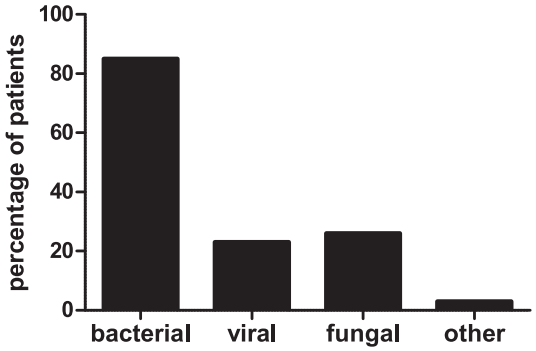


**Fig. 2.** Reported pathogens in questionnaire 1.

neuroborreliosis). In 2 patients the hospital admission was not specified and the other two patients were under investigation for diarrhea or had a head injury.

Total number of deaths was 16 out of 39 patients (41%), including 12 patients that died before completion of the first questionnaire and 4 patients who died during the 2 year follow-up period. The median age at time of death was 69 years (range 46–96 years). Death was attributed to infection or cardiovascular disease in 3 of these patients. The cause of death was miscellaneous, 25% (4 patients) died of an infection and 3 of cardiovascular disease. Two patients died of 'old age' and in 4 patients the cause of death was unknown. One patient died of complications of aplastic anemia and one patient died as a result of malabsorption. Metastatic thymoma was the cause of death in one 80-year-old patient, who passed away 6 years after the initial diagnosis of the thymoma, which was a WHO type B. The Kaplan Meier survival analysis (Fig. 3a) shows a 5-year survival of approximately 82% and 10-year survival of 68%.

**Table 4**
Reported autoimmune diseases.

| Autoimmune disorders | Number of patients (% of 33 reported autoimmune disorders) |
|---|---|
| Pure red cell aplasia | 8 (24.2%) |
| Lichen planus | 7 (21.2%) |
| Myasthenia gravis | 3 (9.1%) |
| Aplastic anemia | 2 (6.1%) |
| Idiopathic thrombocytopenic purpura | 2 (6.1%) |
| Athralgias and/or tenosynovitis | 2 (6.1%) |
| Ulcerative colitis | 1 (3.0%) |
| Celiac diseases | 1 (3.0%) |
| Adrenal insufficiency | 1 (3.0%) |
| Addison's disease | 1 (3.0%) |
| Alopecia areata | 1 (3.0%) |
| Leucopenia | 1 (3.0%) |
| Thrombocytopenia | 1 (3.0%) |
| Mucous membrane pemphigoid | 1 (3.0%) |
| Vitiligo | 1 (3.0%) |
| Rheumatoid arthritis | 1 (3.0%) |
| Sjögren's syndrome | 1 (3.0%) |
| Chronic urticaria | 1 (3.0%) |
| Primary sclerosing cholangitis | 1 (3.0%) |
| Autoimmune hemolytic anemia | 1 (3.0%) |
| Myelo-radiculitis | 1 (3.0%) |
| Limbic encephalitis | 1 (3.0%) |

Table 4 Autoimmune manifestations.

The median survival is 14 years. With a multivariate Cox Regression analysis, the effect on mortality of immunosuppressives use (no n = 30, yes n = 13, HR: 0.3, 95% CI: 0.1–1.2) and the presence of autoimmune diseases (no n = 22, yes n = 21, HR 2.9, 95% CI 0.8–10.1) was determined. Gender (man n = 20, woman n = 23) was not associated with a significantly higher mortality (HR 0.9, 95% CI 0.3–3.0).

**Table 3**
Reported pathogens.

| Pathogens | Number of patients Q1 (% of 91 reported pathogens) | Number of patients Q2 (% of 15 reported pathogens) | Additional remarks |
|---|---|---|---|
| Bacteria/mycobacteria | | | |
| *Haemophilus influenzae* | 18 (20%) | 4 (27%) | |
| *Streptococcus pneumoniae* | 12 (13%) | 1 (7%) | |
| *Pseudomonas* | 7 (8%) | 4 (27%) | |
| *Campylobacter* | 7 (8%) | | |
| *Staphylococcus* | 3 (3%) | 1 | |
| *Escherichia coli* | 3 (3%) | 1 (7%) | |
| *Moraxella* | 3 (3%) | 1 (7%) | |
| *Clostridium difficile* | 2 (2%) | | |
| *Klebsiella* | 2 (2%) | | Bronchitis/pneumonia |
| *Proteus mirabilis* | 1 (1%) | | |
| *Enterobacter asburiae* | 1 (1%) | | |
| *Mycobacterium chelonae* | 1 (1%) | | Lower respiratory tract |
| *Ureaplasma* | 1 (1%) | | |
| *Bacteroides fragilis* | 1 (1%) | | |
| *Francisella tularensis* | 1 (1%) | | Abscesses |
| *Enterococcus faecium* | 1 (1%) | | Sepsis |
| Viruses | | | |
| Cytomegalovirus | 6 (7%) | 1 (7%) | |
| Herpes simplex virus | 3 (3%) | | 1 meningitis |
| Hepatitis C virus | 1 (1%) | | |
| Respiratory syncytial virus | 1 (1%) | | |
| Varicella zoster virus | 1 (1%) | | |
| Fungi | | | |
| *Candida* | 9 (10%) | 2 (13%) | Mostly oral or vaginal |
| *Aspergillus* | 1 (1%) | | |
| *Tinea* | 1 (1%) | | |
| *Pneumocystis jiroveci* | 1 (1%) | | Pneumonia |
| Other | | | |
| *Toxoplasma* | 1 (1%) | | Retinochoroiditis |
| *Blastocystis hominis* | 1 (1%) | | |
| *Giardia lamblia* | 1 (1%) | | |

Table 3 Abbreviations: Q1 = baseline questionnaire, which reported all infections up until the date of the questionnaire; Q2 = follow-up questionnaire, which reported infections in the 2 years since the baseline questionnaire.

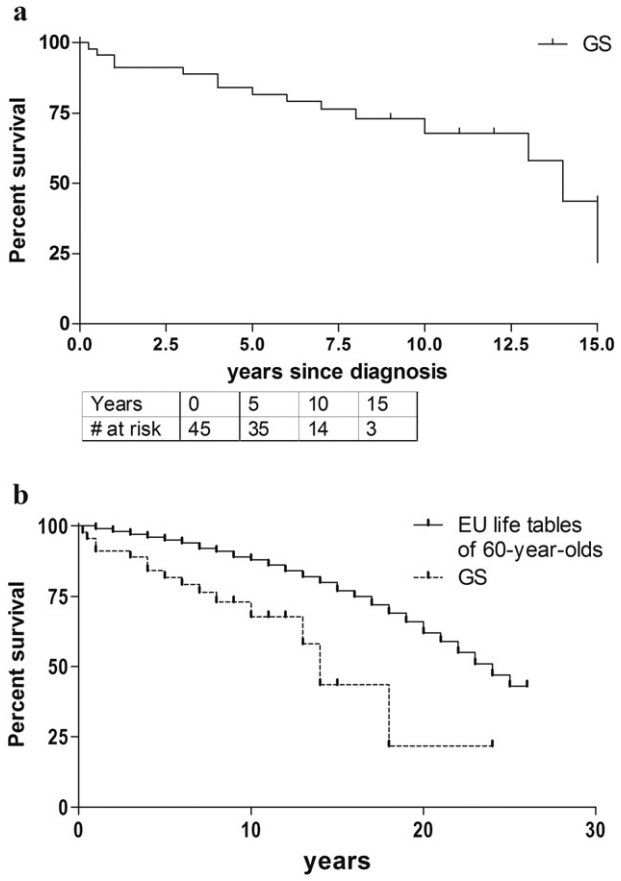


**Fig. 3.** Kaplan Meier analysis. (a) Kaplan Meier analysis of Good syndrome (GS) and table of subjects at risk. (b) GS compared to the general population according to the European life tables ($p = 0.002$, HR 3.7, CI 1.6–8.3) [6].

We have also compared GS patients to the age-matched general population according to the European life tables from 2005. The survival of patients with GS is statistically significantly reduced compared to the age-matched normal population of 60-year-olds. The general population has a 5-year survival of 95% compared to 82% of Good syndrome patients ($p = 0.002$; Fig. 3b).

## 4. Discussion

In our study, involving nearly 500 patient-years of follow-up in patients with GS, we found a median survival of 14 years and median age at death of 69 years. Overall mortality in this study was 41%, with 25% of deaths being a direct result of infection, despite the fact that almost all patients were treated with immunoglobulin and more than half received some form of antibiotic prophylaxis. Autoimmune disorders were a significant cause of morbidity in this patient cohort, observed in 51% of patients.

As previously reported by Kelesidis and Yang [4], patients with GS are prone to bacterial, viral and fungal infections. This was confirmed in our study by a high number of viral (23%) and fungal (26%) infections for a predominantly humoral immunodeficiency. We found that CD4+ T-cell count was only mildly decreased in most patients. Moreover, we were unable to detect a difference in CD4+ T-cell count in patients with and without opportunistic infections. CD4+ T-cell count can be influenced by different factors such as age [8,9], infection, and immunosuppressive therapy, so the observed decrease in CD4+ T-cell count may not be significant. This makes a functional T-cell defect more likely to be central to the development of viral and fungal infections than the observed slight CD4+ lymphopenia. This is corroborated by earlier studies on T-cell defects in Good syndrome patients [10]. Although most physicians reported that their patients still had infections in the 2-year follow-up period, which was a median of 9 years after diagnosis, only 3 patients had severe infections for which they were admitted to hospital. In our patients, GS progressed heterogeneously, leading to infections, autoimmune manifestations and some patients were asymptomatic on immunoglobulin therapy.

We found a median survival 14 years in 47 GS patients, which is better than reported previously. In a study performed by Hermanszweski dating from 1993, CVID patients were compared to patients with thymoma associated immunodeficiency. Five years after the start of symptoms, approximately 70% of these thymoma associated immunodeficiency patients ($n = 7$ in total) was still alive, and after 15 years all patients had died. Thereafter, thymoma associated immunodeficiency has been considered a condition with a poor prognosis, which is markedly worse than CVID. Only recently Malphettes et al. [11] reported on survival of a cohort comprising 21 GS patients from a single center, which was better than expected. This strengthens our observation that although GS may have a heterogeneous course, overall survival is better than described in previous reports.

Good syndrome shares multiple features with CVID, such as type of immunodeficiency and autoimmune phenomena. Recently, two genetic mutations in three patients have been identified involving two members of the Tumor Necrosis Factor Receptor superfamily i.e. TACI protein and BAFF-R [12–14]. Interestingly, mutations in these genes are associated with CVID in some families, although the mutations can also be present in unaffected individuals, which suggests that these mutations increase the risk of immunological abnormalities or are disease-modifying rather than having a direct causative role. Differences between GS and CVID include the older age of onset, and the profoundly reduced B-cell count. Although Good syndrome has been described as a distinct entity because of these differences, the similarities in clinical manifestations and the possible association with these mutations are remarkable.

Mortality in our study was higher than in CVID, which is reported at 15% after a median of 22 follow-up years, although mortality strongly depends on the complications [15]. The diagnostic delay in Good syndrome (median 1 year) is less than in CVID (median 5 years, [15]), so this is unlikely to contribute to this difference. Median age at diagnosis in a large study on CVID was 30 years for men and 33.5 years for women. Their mean age at death is 44 years for men and 42 years for women [16]. This differs from GS patients as their median age at diagnosis is 58 years and their mean age at death is 70 years. This large age difference will affect the prognosis. Therefore, when put into perspective, Good syndrome mortality is likely similar to mortality of 60-year-old CVID patients.

This study was the first to focus on course and prognosis of Good syndrome. In contrast to other studies on Good syndrome, we used questionnaires to collect previously unpublished data and follow up data. A limitation of this study was the small number of subjects, making it hard to obtain sufficient power to analyze groups. The number of subjects also was too small to detect low incidence comorbidity, such as malignant lymphoma, which would also require a longer follow-up period. Given the increased incidence of cancer and lymphoma in CVID patients, this may well be a feature of Good syndrome.

All patients enrolled in this study had hypogammaglobulinemia and thus met the criteria for classical Good syndrome. Since the first case described by Dr. Good in 1954, hypogammaglobulinemia is regarded as the most important laboratory feature of Good syndrome. However, several studies on thymoma patients have identified patients with other immune impairments, but with normal immunoglobulin levels. Montella et al. [2] studied 18 thymoma patients of which 9 patients had a B-cell lymphopenia and 4 patients had a low T-lymphocyte number, while only 4 patients had hypogammaglobulinemia. Thongprayoon et al. [17] studied 87 thymoma patients. Eight patients with clinical symptoms suspicious for an immunodeficiency were tested and although 5 patients had an inverted CD4/CD8 ratio and 3 had B-cell

lymphopenia, only one patient had hypogammaglobulinemia. In addition, Holbro et al. [18] documented infections in 29 thymoma patients, 52% of these patients had at least one infectious episode. Some of these infections were severe or opportunistic in the absence of immunosuppressive treatment. After surgery, only one patient had low immunoglobulin levels and a B-cell lymphopenia. These studies show that there are probably thymoma patients with other immune defects than hypogammaglobulinemia. Whether these patients will in time develop hypogammaglobulinemia is unclear. The International Union of Immunological Societies Expert Committee for Primary Immunodeficiency uses thymoma and immunodeficiency as definition and does not distinguish between different immune defects [19]. Use of the distinction between 'classic' and 'probable' Good syndrome (see Methods) will allow further investigations, while still including all thymoma patients with immune disorders.

In conclusion, Good syndrome is a complex immunodeficiency characterised by variable phenotype and with similarities to CVID. The 5-year mortality rate of patients with Good syndrome is higher than that of patients with CVID, but this is more likely due to their much higher age at diagnosis (mean 60 versus 30 years) than to overall greater severity of disease. The combination of a high susceptibility to a myriad of infectious diseases and concomitant autoimmune diseases requiring immunosuppressive therapy makes treating Good syndrome a challenging task. Our study on one of the largest international cohorts indicates that immunosuppressive therapy and autoimmune diseases are not associated with a worse survival. Despite the challenge of infection and autoimmunity, we show that the prognosis of Good syndrome is better than described previously.

## Conflict of interest

The authors declare no conflict of interest.

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