

The High Medical Cost of Celiac Disease Missed Diagnosis: Is it Cheaper to Suspect it in Time?

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Abstract

Although celiac disease (CD) is one of the most common lifelong disorders worldwide, the rate of correct diagnosis is still low. Studies comparing costs of missed CD diagnosis and economical advantages of early CD diagnosis are still lacking. Our aim was to compare the medical cost of a missed CD diagnosis with the minimal expenditure for its correct diagnosis.

Twenty-eight patients newly diagnosed with CD were recruited. Accurate medical history of 3 years preceding CD diagnosis was collected.

The cost of tests/surveys was acquired from health insurance claims in Italy and USA. Final medical cost was obtained for Italy and USA and compared to the minimal expenditure of a correct CD diagnosis.

The mean cost resulted in 135.87 € (Italy) and 2916.00 \$ (USA) per each year of delay in CD diagnosis. On the contrary, the ultimate cost of an appropriate diagnosis amounts to only 203.49 € and 2707.00 \$.

Data show that each year of delay in CD diagnosis is associated with a significant increase in medical care costs. Since CD diagnosis sometimes requires even more than 10 years of medical interventions, its early detection can lead to a considerable saving of both economic and medical resources.

Keywords: Celiac disease; Early diagnosis; Medical cost; Cost of health care; Health economics

Introduction

The socio-economic development of a country depends on both economic growth and spending review. Health care represents one of the higher costs (5.7%-16% of the gross domestic product - GDP) and in developed countries it is even growing up. When economic resources are lacking as it happens nowadays, health expenditure frequently becomes object of cost cutting.

In this contest of austerity, methodological errors while making diagnosis of many diseases represent an unacceptable waste of economic resources and time. Celiac disease (CD) diagnosis can be taken as a clear example of such a condition of waste.

CD is a systemic autoimmune disorder resulting from the interaction of dietary gluten, genetic pattern and specific immunological state [1]. It can lead to well recognizable intestinal damage, but also to unexpected complications and comorbidities, such as autoimmune disorders [2].

The typical clinical presentation contemplates abdominal bloating, chronic diarrhea and weight loss, but CD can also occur with

osteoporosis, iron deficiency anemia, sterility, poliabortivity, ataxia and epilepsy. This atypical signs and symptoms make CD diagnosis difficult to reach and it could be even more complicated by gluten-related dermatitis herpetiformis, thyroiditis, type 1 diabetes, vasculitis and/or rheumatic disorders [3,4].

Even if CD is one of the most common lifelong disorders in Europe (overall prevalence 1%, specifically 1.2% in Italy [5]) and in USA (prevalence 0.9% [6]), the rate of correct diagnosis is still low. It is not only due to the above-mentioned atypical clinical presentation, but also to expensive incorrect diagnostic strategies, such as inappropriate serological tests, endoscopic examination and their timing of administration.

Historical data for the current expense of delayed CD diagnosis are still lacking and only approximately estimated values are up today available. Moreover, long-term benefits and cost-effectiveness analysis of an early diagnosis of CD have not yet been studied.

Aim of the present study was to evaluate the total cost of a delayed CD diagnosis as often happens in incorrect diagnostic pathways, calculating number and costs of unnecessary tests/surveys usually performed before CD diagnosis itself is achieved, in a cohort of patients afferent to our GI unit.

Materials and Methods

Study population. A total of 28 newly-diagnosed CD patients (10 male and 18 female, mean age 30.8, range 18-65 years) presenting abdominal complaints from at least three years, were consecutively recruited. All these patients showed a clinical picture suggestive of CD: serological EMA and/or anti-tTG antibodies showed positive results and the duodenal biopsy samples presented villous atrophy with crypt hyperplasia (according to Marsh-Oberhuber classification) [7]. Some of these patients, since suspected of functional bowel disorders (mainly irritable bowel syndrome), had previously undergone an unsuccessful symptomatic treatment. Conversely, the complained symptoms quickly resolved after a gluten free diet. The clinical presentation of the patients studied is reported in Table 1.

No. of Patients	Clinical presentation
8	Persistent abdominal discomfort, bloating, meteorism
8	Suspected irritable bowel syndrome (varying from diarrhea to constipation)
7	Chronic fatigue, diarrhea
2	History of sideropenic anemia, infertility
1	Chronic anemia, type 1 diabetes
1	Delayed puberty
1	Persistent anemia, hypocalcaemia from 20 years

Table 1: Main clinical presentation of the 28 patients being studied

All procedures followed in this study were in accordance with the ethical standards of the institutional committee responsible for human experimentation. Informed consent was obtained from each patient enrolled in the study.

Study design

The total amount of laboratory tests and medical surveys carried out during a period of 3 years before CD diagnosis was collected reevaluating the clinical history of each patient. Costs of these procedures were assessed using health insurance claims in Italy and USA. Referring to Europe (Euro €) and USA (U.S. Dollars \$), the costs of each test/survey was acquired from Italian National Institute of Statistic (ISTAT) and American Health Insurance, respectively. All these updated costs are reported in Table 2.

Laboratory tests	Costs		Medical surveys	Costs	
	Euro	U.S. dollars		Euro	U.S. dollars
CBC	3.31	67.00	EGDS	56.81	600.00
ESR, Amy, LP, Chol	9.32	271.00	COL	61.97	3,600.00
Ca	2.78	46.00	Abd Us	60.43	357.00
Fer, Tf	24.27	140.00	Abd MRI	160.00	1,546.00
Fol	19.11	85.00	BMD	63.00	220.00

FOBT	0.79	45.00	Gastroenterol exam	20.66	450.00
EMA	19.11	194.00	Gynecol exam	20.66	450.00
Anti t-TG	19.11	234.00			
TSH, fT3, fT4	57.33	137.50			

Table 2: Costs of the laboratory tests and medical surveys often performed before a correct diagnosis of CD in Europe (Euro) and USA (U.S. dollars)

CBC: Complete Blood Bount; ESR: Erythrocyte Sedimentation Rate; Amy: Amylase; LP: Lipase; Chol: Cholesterol; Ca: calcium; Fer: Ferritin; Tf: Transferrin; Fol: Folate; FOBT: Fecal Occult-Blood Testing; EMA: Anti-Endomysial Antibodies; Anti t-TG: Anti-Tissue Transglutaminase; TSH fT3 and fT4: Thyroid Hormones; EGDS: Esophagogastroduodeno-scopy; COL: Colonoscopy; Abd Us: Abdominal Ultrasound Sonography; Abd MRI: Abdominal Magnetic Resonance Imaging; BMD: Bone Mineral Densitometry; Gastroenterol exam: Gastroenterological Examination; Gynecol exam: Gynecological Examination.

On the basis of these data and considering the quantity of tests/surveys performed in 3 years before CD diagnosis, the total cost was calculated. Thereafter, these medical costs were compared with the expenditure for the strictly necessary investigations to reach CD diagnosis. It includes: 3 gastroenterological examinations; 1 serological EMA and anti-tTG antibodies determination; 1 esofagogastroduodenoscopy (EGDS) with biopsy sampling and histological analysis. Three gastroenterological examinations are used respectively for: case finding; evaluation of antibodies/EGDS prescriptions, diagnosis/diet instructions.

All calculations and graphical representations were performed by using GraphPad Prism package (GraphPad Software Inc., San Diego, CA, USA).

Results

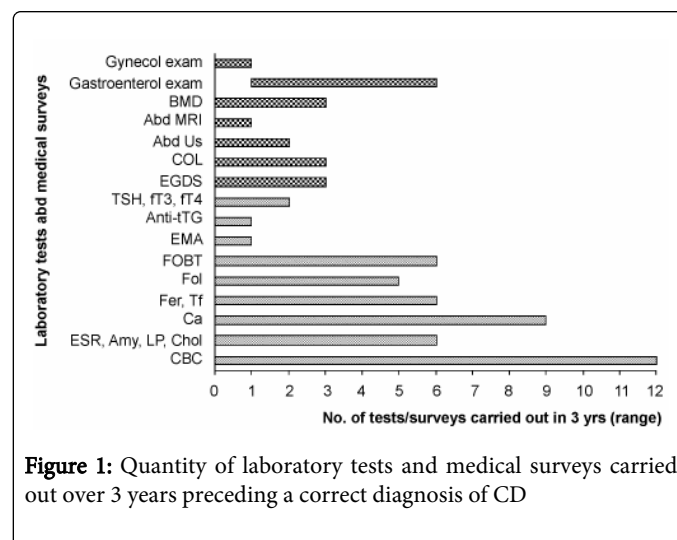


Figure 1: Quantity of laboratory tests and medical surveys carried out over 3 years preceding a correct diagnosis of CD

The quantity of laboratory tests and medical surveys (carried out over 3 years preceding a correct diagnosis of CD) was obtained for each patient and plotted on the graph (Figure 1): in 3 years, among the

other tests and surveys reported, the patients underwent up to 6 gastroenterological examinations, 3 colonoscopies, 3 esophagogastroduodenoscopies, 2 abdominal ultrasound sonography scans, 1 abdominal magnetic resonance imaging scan and 12 complete blood counts. The total cost of these medical services was calculated and plotted on the graph (Figure 2). Among the others, colonoscopies (approximately 80€ and 5000\$), esophagogastroduodenoscopy (approximately 60€ and 600\$) and gastroenterological examinations (more than 60€ and more than 1000\$) resulted to be the most expensive procedures in 3 years.

The quantity of laboratory tests (histograms with diagonal lines) and medical surveys (histograms with squares) carried out over 3 years preceding a correct diagnosis of CD was obtained from all patients in study and therefore, was plotted in the graph as minimum and maximum value (range).

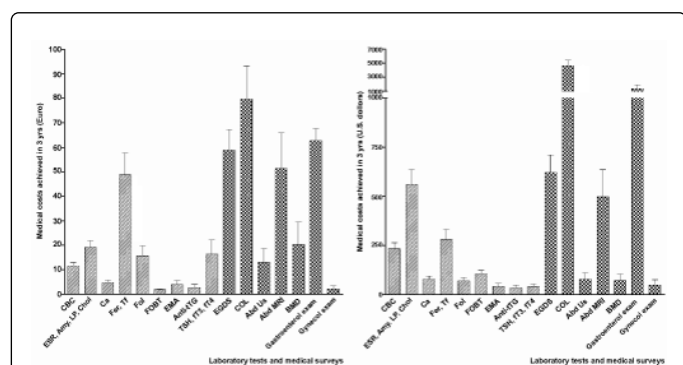


Figure 2: Medical costs achieved over 3 years preceding a correct diagnosis of CD in Europe (Euro) and USA (U.S. dollars)

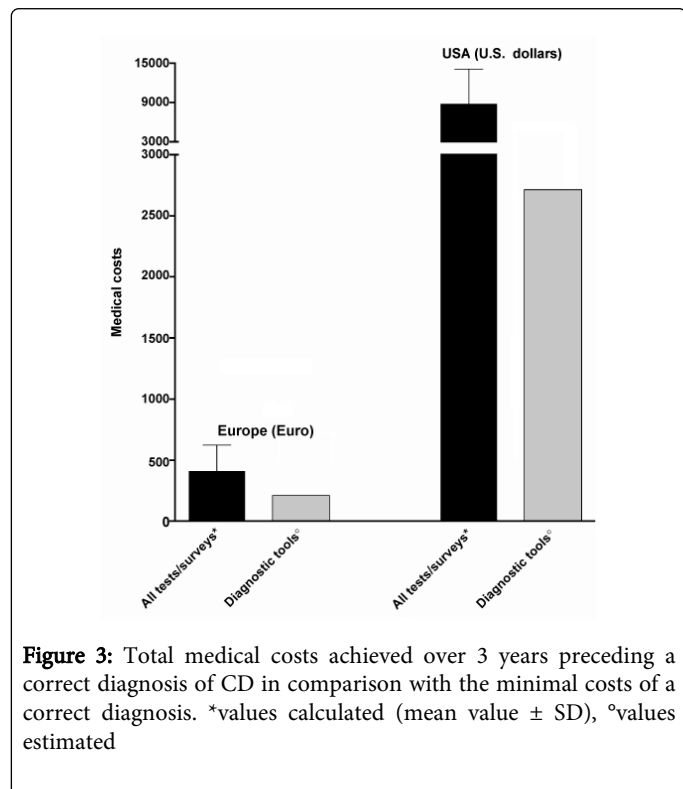


Figure 3: Total medical costs achieved over 3 years preceding a correct diagnosis of CD in comparison with the minimal costs of a correct diagnosis. *values calculated (mean value \pm SD), °values estimated

The medical costs of laboratory tests (histograms with diagonal lines) and medical surveys (histograms with squares) achieved from the patients in study over 3 years preceding a correct diagnosis of CD were calculated both in Euro (A) and in U.S. dollars (B) and thus, were plotted in the respective graphs as mean value \pm standard deviation (SD). The total expenditure over 3 years before CD diagnosis amounted to 407.61 € in Italy and 8748.00 \$ in USA, whereas an ultimate CD diagnosis required 203.49 € and 2707.00 \$ (Figure 3). The total medical costs achieved from the patients in study over 3 years preceding a correct diagnosis of CD (histograms called “All tests/surveys”) and the minimal costs of a correct diagnosis (histograms named “Diagnostic tools”) were calculated/estimated either in Euro or in U.S. dollars and therefore, were plotted in the graph.

Discussion

Improving the health care system requires simultaneous pursuit of three aims: improving the experience of care, improving the health of populations and reducing per capita costs of health care. These three components are not independent of each other. Changes pursuing any one goal can affect the other two, sometimes negatively and sometimes positively. For example, improving care for individuals can raise costs if the improvements are associated with new, effective, but costly technologies or drugs. Conversely, eliminating overuse or misuse of therapies or diagnostic tests can lead to both reduced costs and improved outcomes. On the basis of this assumption, a diagnostic delay (often affected by medical negligence or liability) can lead to an expenditure increase, especially in case of chronic life-long diseases. In the present study, we analyzed a sample of 28 consecutive newly-diagnosed CD patients, to evaluate the medical cost sustained until the achievement of a correct CD diagnosis. The mean cost was calculated considering only the expenditure of the last 3 years before the diagnosis, assuming this span of time an adequate “spending meter”. As expected, delay in diagnosis represents a waste of time and money that invariably rises clinical and social implications. In fact, when laboratory tests and medical surveys don’t give a definitive solution to patients’ symptoms, further ancillary tests and visits are usually asked.

Specifically, the excessive expenditure of money can often be due to a lack of specific diagnostic question: laboratory tests, endoscopic or radiologic exams are often prescribed without a specific suspect for CD. For this reason, patients are forced to repeat the same exams many times.

Money waste is also consequence of a frequent incorrect (or even omitted) application of the most specific and sensitive diagnostic strategies: results are frequently influenced by an already started gluten-free diet before a definitive CD diagnosis or by immunosuppressive therapy. Moreover, despite the fact that organ culture system has showed its usefulness when histological or serological data are not clearly diagnostic for CD, nowadays it is not generally included in diagnostic protocol yet [8].

Results from the present work report only the real expenditure of tests and clinical examinations performed three years before CD diagnosis. Treatment with iron, calcium and vitamins, as well as the indirect costs related to time lost from work, school or other activities, were not included, even if associated in 10-30% of cases [9,10]. Neither all the symptomatic treatments were calculated. Since it takes an average of 10 years to get a proper diagnosis of CD, the costs are certainly even higher than those reported in this study, together with a considerable worsening in quality of life. Data were found

homogeneous in Italy and USA, even despite the different health system organizations.

In the last years, the debate about the necessity of increasing awareness of atypical symptoms and performing a mass screening, or waiting for overt typical presentation, fluctuates between hazards and costs of a delayed diagnosis and the real utility to anticipate it [11-14]. Screening has been indicated as a cost-effective procedure in patients with suspected irritable bowel syndrome or in high-risk subjects since the prevalence of CD is as high as 1% and even more [15,16]. The present study has not been designed to shed any light on the advisability of CD screening and we agree that more evidences should be gained before a wide CD screening could be accepted. However, we cannot forget the increasing prevalence of CD [17] and, thus, it should be considered for early diagnosis as one of the most common illnesses in the world. Furthermore, CD satisfies all the five criteria of the World Health Organization (WHO) justifying a mass screening [13].

On the other hand, even a mere increase of physicians' awareness regarding CD could be a feasible and successful strategy for an earlier detection of CD [18]. In full agreement with this and other recent studies [19,20], our data also suggest that an early diagnosis of CD could give economic advantages. The increased quantity of tests/surveys performed by each patient aggravates the medical costs sustained before reaching a correct diagnosis of CD. Some patients studied presented also several and unspecific extra-intestinal symptoms, leading to a delay in CD diagnosis [5,6,13]: our data encourage not only gastroenterologists, but also the whole physician community to pay more attention to these atypical manifestations in order to avoid useless costs. Finally, it should be kept in mind that in chronic diseases symptoms are always sign of actual damage, thus a quick and effective search for the cause should be strongly recommended.

At first glance, awaiting for specific clinical presentation of CD could seem a useful reduction in expenditure for gluten-free diet, specific test performances and clinic follow-up. On the other hand, it is possible to demonstrate that, on the basis of the cost/effectiveness ratio, a delayed approach to diagnosis is actually more expensive: both cost-effectiveness ratio and quality-adjusted life year (QALY) improve as soon as the diagnosis of CD is reached and a gluten free diet is started [21,22]. Moreover, in our opinion, to postpone the diagnosis is not ethically acceptable, also because of the risks associated to a late or missed CD diagnosis, including intestinal lymphomas and other cancers [23].

Furthermore, an early CD diagnosis may be also cost-effective for insurance companies, because it could reduce the risk of workers' compensation costs.

In conclusion, we are aware that this study does not deal with the cost of a general population screening for CD and it only focus on the costs of targeted CD case finding. However, these data represent a further boost to make an early diagnosis of CD, increasing the awareness of both typical and atypical clinical presentations, and to use the ultimate diagnostic procedures.

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