AL Amyloidosis: New Drugs and Tests, but Old Challenges

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Immunoglobulin light chain (AL) amyloidosis develops in 2% of individuals with monoclonal plasma cell dyscrasias. In this issue of ONCOLOGY, Drs. Gertz and Dispenzieri discuss AL amyloidosis, highlighting progress in the field along with outstanding challenges.

The authors present two cases that illustrate the frequent problem of late diagnosis that can arise when patients present with nonspecific clinical features. It is also possible that a lingering perception that amyloidosis is untreatable may discourage further diagnostic work-up, which generally requires biopsy confirmation, especially in the older patients among whom AL amyloidosis is most common. However, the authors emphasize that certain combinations of clinical features should trigger investigation for amyloidosis, including co-existent peripheral and autonomic neuropathy, cardiac failure in association with proteinuria or marked gastrointestinal symptoms, and left ventricular “hypertrophy” in the absence of a clear cause. The index of suspicion should be heightened in patients with monoclonal gammopathy of undetermined significance (MGUS), in whom the suspicion of transformation into AL amyloidosis may be signalled by asymptomatic proteinuria on routine dip stick testing, or by elevation of the serum cardiac biomarker N-terminal fragment of brain natriuretic peptide (NT-proBNP).[1] Regrettably, the majority of patients with AL amyloidosis present out of the blue, and there is often major amyloid involvement of at least one vital organ system at diagnosis. A recent advance that would have been informative in both patients described by Gertz and Dispenzieri is cardiac MRI,[2] which can reliably differentiate between myocardial hypertrophy and expansion of the interstitial space by amyloid deposition. Increased access to cardiac MRI has lately led to a remarkable increase in diagnosis and referral to the UK National Amyloidosis Centre of patients with senile transthyretin cardiac amyloidosis, who almost always present with heart failure associated with preserved systolic function. In addition to cardiac MRI, we have also lately validated 99m-labeled technetium-3,3-diphosphono-1,2-propanodicarboxylic acid (99mTc-DPD) CT-SPECT scintigraphy in our center as a sensitive, quantitative method for imaging transthyretin cardiac amyloid deposits. This bone scan tracer localizes with great affinity in all patients with cardiac transthyretin amyloid, and in a significant proportion of those with AL type, although the basis for this is not known.[3]

Ultimately, the diagnosis of amyloidosis must be supported by demonstration of amyloid in the tissues. While this can be achieved in specialist centers by means of serum amyloid P component (SAP) scintigraphy,[4] biopsy histology is accessible widely, and offers the means for identifying amyloid fibril type immunohistochemically or through laser capture microdissection and mass spectrometry, as described in Table 2 of Gertz and Dispenzieri’s review. In our own experience, immunohistochemistry is nondiagnostic in one-third of cases of AL amyloidosis, supporting the frequent need for mass spectrometry as back-up, although availability and turnaround times remain challenges for this sophisticated new technique. It is certainly not adequate to rely on the mere presence of a monoclonal gammapathy to confirm that amyloid deposits are AL type, considering that MGUS occurs in 5% to 8% of the elderly population,[5] and that wild-type transthyretin amyloid deposits are present at autopsy in 25% of individuals over 80 years of age.[6] Further, more than 5% of patients referred to our own center have hereditary types of amyloidosis, often with no family history.[7]

Our favorable recent experience of cardiac MRI and 99mTc-DPD scintigraphy has not eliminated a conundrum in some patients, which is applicable to the first case presented by Drs. Gertz and Dispenzieri. Is the amyloid detected peripherally in an abdominal fat aspirate necessarily the same type as that in the heart of an elderly patient? Senile cardiac amyloidosis has a better prognosis than AL amyloidosis and is not amenable to chemotherapy; it is vital not to subject an elderly MGUS patient with senile cardiac transthyretin amyloidosis to chemotherapy. At present, cardiac biopsy is
the only way to definitively distinguish cardiac transthyretin (TTR) from AL amyloidosis, and while endomyocardial biopsies must be performed selectively, we are optimistic that algorithms based on some or all of the many cardiac investigations now available can be developed to provide guidance in this area.

Much progress has been made in the treatment of AL amyloidosis in recent years. A search of clinicaltrials.gov for AL amyloidosis identified 48 studies in the 15 years up to 2005 and 63 studies in the 6 years since. In addition, the great unmet need in amyloidosis has gradually come to the attention of the pharmaceutical industry. Rapid and substantial reduction in amyloidogenic free light chain production can improve prognosis greatly. Amyloidogenic plasma cells appear to be exceptionally sensitive to the apoptotic effects of proteosome inhibitors,[8] and early data suggest that this translates into deeper clonal responses and more frequent and rapid organ responses in patients treated with bortezomib.[9] Subcutaneous administration of bortezomib and newer proteosome inhibitors with reduced toxicity may improve the treatment of patients with more advanced disease. While there has been a mushrooming of novel agents and drug combinations in myeloma, it will remain vital to identify therapies that produce responses in AL amyloidosis that are rapid and as complete as possible. Amyloidotic organ responses, which depend on hematologic response, may be very slow, and the combination of free light chain assays and measurement of cardiac biomarkers provides crucial early information that can guide therapy remarkably effectively.

SAP scintigraphy is used routinely in the United Kingdom to serially track whole-body and organ amyloid load, while new technologies, such as MRI quantification of the interstitial space occupied by amyloid and possibly amyloid-specific agents for positron emission tomography (PET) are in development.

Despite these developments, Drs. Gertz and Dispenzieri provide data from the Mayo Clinic over a 30-year period that show disappointing progress in treatment of patients with advanced disease, with 30% to 40% of deaths still occurring during the first year. Treatments that directly target the amyloid deposits are thus urgently required, and promising immunotherapy approaches are in development.[10,11] Our own such approach utilizes antibodies to SAP,[11] a universal constituent present in all amyloid deposits; these antibodies trigger near complete clearance of experimentally induced amyloid deposits within 2 weeks.

Amyloidosis is moving into the mainstream, and growing interest from the pharmaceutical industry is both welcome and exciting. However, despite much progress, late diagnosis and management of advanced disease remain thorny challenges. At least they are ones that clinicians and researchers are now vigorously addressing, offering new hope for patients with this grim disease.

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